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The Oldest American Aeronautical Magazine

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Truth and the test pilot

By Edmund T. Allen

THIS day of the dare devil "test pilot," who took the new airplane up "to see it would fly," has passed. We have another to test the wings for their soundness, not to find out whether the airplane is trustworthy in longitudinal stability or controllability. Strength features are given before with careful credit to precision from stress analysis and static test before the airplane is flown, and stability and controllability have usually been determined to a high degree of accuracy prior to flight by aerodynamic analysis and wind tunnel tests. Unless an airplane

departs radically from conventional design there is no more doubt about these questions at the designer's hand, as he studies his model in the air for the first time, than a modern yacht designer would have regarding the buoyancy or stability of his craft as it slips down the ways at the christening. The test pilot of a few years ago came down from the first flight of a new airplane and told an admiring audience that the plane was

The results of performance tests are often valuable because of poorly controlled test conditions and lack of understanding between test pilots and designers. It is essential that a test pilot have not only manual proficiency, but technical knowledge and scientific sense as well. Mr. Allen has unique qualifications for discussing that problem. He writes as a pilot who has constantly interspersed engineering studies with flying activity. He was an officer in the Air Corps during the War, and a civilian test pilot for the Army at McCook Field after the war. He flew for the National Advisory Committee for Aeronautics in the first stages of the flight-testing program at Langley Field. He was a pioneer in glider and light plane development, and is the only American ever to have taken a glider of his own design to Europe and flown it as a competitor there (in 1922). He flew the air mail for three years. He has been test pilot and engineer for the Boeing and Northrop Companies, and consultant to others. In short, he speaks with some authority.

"Back," "Out," "A buzzy on the canopy," "A flutter," "Stable as a rock," "You're all at nothing this end," "Can't be stalled." If it was a little "buzzy in landing" or it "squared on a turn," there was little in the nature of concrete data in these reports that could guide the designing engineer in modifying these characteristics. He had to shoot in the dark to make it "less buzzy" or "less squadding" on a turn. If the pilot

one may have measured the distance over. The pilot may have flown across the course both ways, averaging his times "to eliminate the effect of wind." Although he flew on the course, the pilot probably "checked out behind the first house and stopped approximately level all the way across the field." Such methods are not yet superseded by many aircraft companies. Hardly an airport but has its "speed course" and this sort of

and it floundered in landing, that was taken as a blunder, condemnation, and so the pilot may have meant it, for he was used to and forced an airplane which took a "normal" flight path as a glider — "normal" meaning to him "like a jockey" or anything with a minimum L/D of about 8.

After the first test flight and a few others "he got used to the new ship," the test pilot of a short while ago did the "performance tests." He flew across the airport from one fence in the other with wide open throttle. These times were said to be three quarters of a mile apart, some-

Fundamentals of future air express development

By Monte C. Abrams

TRAFFIC in freight and mail has been the controlling factor in the development of land and water transportation systems throughout the world, and it is not unlikely that express traffic will be a major factor in the further development of air transportation. Although there is yet a wide development of opinion as to its ultimate place in the general scheme of air transport, the fact that air express shipments as in the first nine months of 1931 increased more than 200 per cent over the corresponding period of last year, and is now equivalent to more than 12 per cent of total air mail tonnage, indicates the growing importance of this class of traffic.

The first article of this series outlined some of the main existing problems that have confronted possession of air express, and indicated the relatively small progress that has been made in overcoming the wide use of established air express facilities. The second article discussed available sources of volume air express loads. This article will outline the fundamentals of such a service, and will suggest a manner in which it can be provided with a minimum delay and the best possible distribution of present air transport systems.

The following six fundamental factors are believed to represent the maximum requirements that must be met to provide a satisfactory volume of air express traffic:

1. A unified nation-wide service must be provided.
2. Air express traffic must be controlled by a single organization.
3. Express must be handled independently of mail and passengers.
4. Self supporting packing and delivery services must be provided in major cities.
5. Traffic must flow uninterceptedly from origin to destination.
6. Flying operations must be conducted by the established air transport lines.
7. Rates must be uniform, and not higher than those of mail express charges.
8. Schedules must be based on air



express loads alone, without interference.

6. Flying equipment of special and advanced type must be developed.
7. Air shipments must be prepared.

The first and most essential requirement is that the proposed air express service should be developed on the basis of the large shipment from whose volume loads will come serious business interest, and making itself a complete service—as complete as that now provided by the railway express system—will induce there to purchase air express to any great extent.

The problem of developing air express service should not be compared with that of air mail, or passenger traffic. It has been possible to develop air mail traffic in spite of the comparative delay of early flying service because the entire postal system with its thousands of collecting and distributing agencies was backing and promoting the service from the start. Shippers know that an air mail stamp would assure the fastest possible delivery whether or not the person to whom the letter was addressed was on or out of his mail route, and so did not hesitate to purchase the new service generously. Actual flying operations have been secondary to the development of air mail; the primary factor being that as each new air mail route was authorized it first was made into an established system for handling all mail. Here there has been a universal ground-handling system which flying operations have been incorporated into the start. The same cannot be said for air express.

As for passengers, they themselves make a personal determination before each trip, decide which route to follow and which company is preferred, and even take themselves to the terminal as they see fit.

What can go by air?

Let us meet some. Since the traveler's own convenience, comfort, pleasure and safety are at stake, he will take the necessary trouble to make reliable arrangements. A package, however, is at the mercy of its owner, and it is not for one of thousands of shipments requiring attention. If an individual is

sending but one emergency parcel he will probably take the trouble to have it sent by air express, if possible. If the consignor is a large firm sending out hundreds of such shipments daily (and it is from that class of person that real volume of air express loads must come) it is impracticable for his shipping department to examine all packages to determine which can be sent exclusively by air express and then to make the necessary arrangements for each shipment.

So long as large shippers must deal with a number of different air express services, depending upon which part of the country they wish to reach; so long as they must have some shipments handled by several different carrier companies (each with its different set of rates and rules); so long as they are to reach a certain destination; so long as the country is sparsely populated with many individual companies with uncoordinated schedules and unharmonized methods and principles of operation; so long will it be impossible to induce important large shippers in the service of air express on a volume basis.

The second fundamental requirement is that all air express traffic must be controlled by a single organization. No matter how clearly the various independent operators may cooperate with each other it will be impossible to meet satisfactorily the problems of traffic interchanges, packing and delivery and terminal handling, bookkeeping, billing, and tracing of lost shipments, unless that work is handled by a single central business organization. Such an organization must be composed of men who are primarily business executives rather than operating men, and who understand the problems of package pickup and delivery and of the collection and handling of such business.

The individual railroads of the country delegate to a single organization, the Pullman Company, the problem of providing satisfactory sleeping car service. They delegate to a single organization, the Railway Express Agency, the problem of obtaining and handling express bus-

ness. Each of these organizations has full power to conduct its business in a way that will best serve the interests of all members of the group of railroads cooperating in the service. The executives of each group concern themselves only with the actual problems of operation, that matter being handled by railway executives who are qualified experts.

The Post Office Department is an

While the series of articles on the subject of air express has been in process of publication in AVIATION, there have been important developments. Encouraged by the phenomenal increase of more 200 per cent in 1931 over 1930, the Railway Express Agency and five major transport agencies involved in the present national network of air express services have made drastic reductions in rates. The mileage affected exceeds 10,000, 117 airports are touched, and in some cases the new tariff is as low as 9¢ cents per ton-mile on the longer hauls. ¶ These are much that is attractive in the past that air express undoubtedly will play in the changing economic structure, not only of this country but of the entire world. In the face of a fundamental distribution defect, there is a real opportunity for air express to bridge the gap and provide faster service as an aid in reducing inventories. ¶ Since the depression of 1929-31, there has been a definite trend toward smaller, faster, and more frequent shipping rates. To provide this service, extensive warehousing facilities have been introduced. These facilities may be reduced materially through the substitution of air services for slow means of express transportation. Coordination of telephone and telegraph with air express service also should result in better synchronization of production with distribution. ¶ These advantages long have been recognized by those directing European air services, and a high degree of development has been reached in the Eastern Hemisphere. While European practices vary slightly in detail, they are substantially similar to those existing in this country.

Excellent example of the type of organization which must be set up to handle air express traffic properly. It provides a successful collection and distributing organization under the administration of a business man for handling the necessary accounting, billing, collecting, etc. It does not concern itself with actual inter-city operations, but contracts with various airlines, railroads, bus agencies and, through the agency of a single organization, the Pullman Company, the problem of providing satisfactory sleeping car service. They delegate to a single organization, the Railway Express Agency, the problem of obtaining and handling express bus-

ness. Each of these organizations has full power to conduct its business in a way that will best serve the interests of all members of the group of railroads cooperating in the service. The executives of each group concern themselves only with the actual problems of operation, that matter being handled by railway executives who are qualified experts.

The Post Office Department is an expert and profitable to employ the present plan, and it is decided to as great an extent as possible in order to keep operating costs down while the service was being developed. Best volume traffic, however, will require almost complete integration of local companies being by the first time, and in the case of shipments to small towns, to be served by express planes but reached by passenger or mail vehicles.

As a fourth requirement, the ground handling system must be made efficient and self supporting. The present possibilities of air express traffic are not justified by the expense of an individual parcel handling organization as it is now handled; at least not of such organization as must be provided in all major centers to handle the business properly. Local package delivery agencies that are handling profits efficiently in the downtown and suburban districts are already established in all large cities. Arrangements might be made with these established companies to provide air express service with a completely new service from the start. Even when the air express staff becomes great enough to support its own ground organization for parcel handling, it will probably prove more economical to have the work handled by the established companies who are serving the territory.

In all probability there will always be need of the services of such agencies as Postal Telegraph and Western Union in the matter of collecting and handling express loads, and in some cases where no parcel delivery system is



Above: A group of men, selected by various and presented to the first camp by the GVO Aviation School.



Below: One of the members of the GVO Aviation School, who has completed the first course and is now a pilot in the GVO Aviation School.



Below: One of the members of the GVO Aviation School, who has completed the first course and is now a pilot in the GVO Aviation School.

Below: A woman pilot of the GVO Aviation School, who has completed the first course and is now a pilot in the GVO Aviation School.



Below: A group of men, selected by various and presented to the first camp by the GVO Aviation School.

Below: The first flight instructor, who has completed the first course and is now a pilot in the GVO Aviation School.



Aviation in Soviet Russia

From the
GVO



Much has been written on the subject of flight instruction, but little, if anything, has been said of the mental and physical reactions involved in the process of learning to fly. Dr. Forbes, of Harvard Medical School, who is engaged in scientific research in the action of the nervous system, discusses the psychological and physiological phases from his own flying experience.

Learning to fly

By
Alexander Forbes
M.D.

THE technique of flying has many points of similarity and many points of difference with other procedures, such as driving a car, sailing, dancing and boxing. That the process of learning to fly is of both general and special interest. Not only is the learning of airplane control a matter of importance to the student pilot and to his instructor, but it is also of interest to the educational expert, who seeks knowledge of learning processes in general and the scientific investigator of the functions and activities of the nervous system. Being engaged in the scientific research in the learned field of general, and having, after many years, yielded to the pursuit for flight, I have been keenly interested in subjective observations on the learning process in my own case.

By way of background, it may be well to explain that for many years I have been much addicted to making a number of studies and during its history, activities which were undoubtedly helpful in developing some of the faculties involved in flight, and that I have always been constantly engaged in these sports, questioning the eye-hand coordination involved in hitting a ball with a stick, e.g., baseball and tennis. Interest in aviation and the desire to fly have been intense since aviation first began, and while at 27 I began to learn, I had read a good deal about the theoretical and practical aspects of flight, and had been up three times as a passenger. An experienced pilot warned me that at my age, I must expect to learn about twice as long as I have at a young pupil requires. Whether he was actually conservative in his warning, or whether the coordination of sensation to action and experience in the somewhat limited sports I have mentioned, expedited the process, I do not know, but it actually required about 80 or 90 per cent more time to solo and to qualify for a private license than I would by the average student of 18 to 21 (specifically, 135 hours to solo, 20 hours before getting license).

Since different instructors went up with me before I completed my course and that afforded me an excellent opportunity to compare a wide variety of techniques in instruction. For example, I recall one striking contrast of method on two successive days. I had received 36 hours of instruction and was on my fourth lesson in landings. On this day the instructor spent the entire half hour putting me through a rapid series of landings—short run on all, coaching me gently but constantly, and then making me turn, glide in and land without a word of coaching or even a signal. The landing was a poor one, but in two ways the method was good as a signal to the previous day's drilling; it tended to give me self-confidence—the usual thing of all, and it taught me by actual experience how not to land. This method of trial and error is valuable at a certain stage in training, but it should be preceded by enough drilling to establish a foundation of correct habit-formation.

Three distinct elements

There are three distinct but interesting elements in the learning process, the mental, the unbalanced or reflex, and the emotional, that is, the understanding of the nature of the task, the formation of the habit of instinctive reflex action, and the acquisition of confidence. As a student element in training is the building of the habit of reflex reaction by frequent repetition until it becomes instinctive and practically unconscious; this is the establishment of the necessary reflexes in the nerve centers. An equally essential element in the process of self-confidence and expectancy. Certain psychologists have emphasized confidence as a key factor in the learning process.

One instructor, concentrating on landings during six successive lessons, made a point of cleaning my nerves and fastidious in comparing a wide variety of techniques in instruction. For example, I recall one striking contrast of method on two successive days. I had received 36 hours of instruction and was on my fourth lesson in landings. On this day the instructor spent the entire half hour putting me through a rapid series of landings—short run on all, coaching me gently but constantly, and then making me turn, glide in and land without a word of coaching or even a signal. The landing was a poor one, but in two ways the method was good as a signal to the previous day's drilling; it tended to give me self-confidence—the usual thing of all, and it taught me by actual experience how not to land. This method of trial and error is valuable at a certain stage in training, but it should be preceded by enough drilling to establish a foundation of correct habit-formation.

There are two somewhat distinct elements in the confidence which must be acquired. One is confidence in the plane and the air on which it flies as a means of support; the other is confidence in one's ability to handle the plane. As the latter was in my case, combined with experience in flying a fairly marked confidence factor. I had studied the problem, and reason had told me that a half-hour lesson in a good plane with a good instructor would be able to do a half-hour of shopping in a crowded city, with unimagined losses to be dodged. Yet when I was in the air, I found myself had given me a dangerous lack of fear of the machine, the instructor fear of a strange, new element served the same purpose and permitted of a five-hour lesson in the air had enabled the necessary familiarity. Fear is far more closely correlated with unfamiliarity than with experience, hence the highly unusual attitude of the general public.

Air armament standards in the melting pot

By Edward P. Warner
Editor of *Airman*

THE world disarmament conference which is to gather in the great French-speaking town of Geneva early in February has been in preparation since the spring of 1925. Instantaneously during all that time, the Preparatory Commission of experts representing 20-odd countries have been at work, hammering out a preliminary draft of a treaty in which an agreement to limit air, land, and sea armaments would be set. The great conference of 1932 is supposed to revise and amplify the treaty, and to fix in definite figures for armaments at standards.



Per cent of total expenditures
for national defense that is
allocated to air forces (excluding
indirect expenses, per cent.)

some of them have been done to the detriment of advancing very extensive and far-reaching prohibitions.

Immediately after the war there were men, not by any means all in the "Atlantic Group" but among students of international law and military affairs, who advocated the entire abolition of aerial armaments on the ground that the harm it did us was outweighed and over-balanced by good just that it could ever do us in peace. Of course no such suggestions as that are now heard. The benefits of commercial aviation, and the

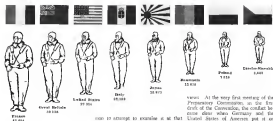
dissemination of all peoples upon our transportation, have become too plain to consider their abandonment. The scheme for the prohibition of all aerial activities has, however, been expanded by the more limited proposal to prohibit all military use of aircraft and "aeronautics" and airplane manufacture and air transport.

Lord Robert Cecil, who has been a leader in the British movement for some limitation for war and who will play a leading part in the forthcoming conference, has recently advocated that drastic action and has received some support. Sir Gilbert Murray has done this since the war began. From Germany an almost sure, and indeed the right, back ground of the negotiation is that Germany is already forbidden to have any military aviation under the peace treaty of 1919, that she is getting close enough without it, and that it would be easier and better to give it up altogether. She

thus to establish equality by re-creating having German military air power side by side with that of the other nations. There has been no official statement of American official policy upon that far-reaching proposal, but observation of the attitudes of other European governments, and especially of that of France, suggests that the wish are several hand in to air systems, any effective restriction of military aviation as a peace time arm.

Eliminating bombers

Another possibility, of a more limited order, is the abolition of bombardment aviation. The latest version of air war have worked with greater force upon the minds of a post-war generation. Non-technical men estimating the nature of future wars are more apt to accept with the old-fashioned criticism, and even to



Personnel of the air forces of
the great powers. (From their
reports to the League of Nations)

reject any, the enthusiastic claims for air power of Gen. William Mitchell and others of his general school of thought. When writers on international relations draw pictures of the warfare that is to come, the bombing airplane and poison gas are the twin villains of the piece. There is undoubtedly a widespread sentiment, which will very probably make itself heard in Geneva in the spring, for the complete abandonment of all bombardment and all bombing aviation as a measure to reduce the horrors of war for civilian populations. Like the complete abandonment of military force, however, it is almost certain to get nowhere. Unwisdom could not possibly be stoned, if only because of the extraordinary difficulty of defining a bombing airplane, or of distinguishing between a bombing and a converted type, and so it is almost certain that the idea against prohibition for bombardment would be shattered with several good truths.

The proposal for such a stipulation against any bombardment or prohibition thereof has, as a matter of fact, already been officially launched. In the 1929 meeting of the Preparatory Commission the German delegation argued that there be included in the draft some provision a provision against any preparation for such war. It was vigorously opposed by Lord Bessborough, British German ambassador to the United States, and by the Russian representative. It was opposed by a number of other members of the conference, and it became they were specifically opposed to the elimination of bombing as on the ground that the whole question was too complex for the Preparatory Commission

to attempt to examine it at that time. The American delegate, in particular, put his own advice into effect of expediency. But in the end, the German suggestion received the support of five countries out of the 20-odd represented in the meeting.

Civil and military aviation

When the conference shambles through some half a dozen resolutions on civil and partial prohibition of military force, and undertakes the development of such system of limiting military air power by means of assigned standards, it will come at once to grips with the problem of distinguishing between military and civil aviation. Upon that problem, and the related responsibility of drawing a hard and fast dividing line between military aircraft and those not designed to be used for military purposes, the first action of the Allied Powers is to prohibit German military aviation after the War and with ship wreck. The definition of military aircraft that has been prepared in 1929 proved unworkable, and had to be abandoned in favor of provisions more flexible and more general. The same question, that of distinction between the military and the civil uses of aviation, has been the subject of innumerable pages of debate in the meetings of the Preparatory Commission at Geneva. It will undoubtedly be the subject of an even more controversial debate at the conference during the coming spring and summer.

When the subject was first broached, the nations at once divided into two groups, with various shadings of opinion within each one. France stands at the common boundary of one group, and most of the nations of continental Europe, except the Germans and Scandinavians, hold views approximating that of France. At the other extreme of the other group are Germany, and the United States, with the British Empire, the Netherlands, Japan, and the Scandinavian countries displaying a large measure of sympathy with their

views. At the very first meeting of the Preparatory Commission, on the first draft of the Convention, the conflict between those who regard Germany and the United States of America put it as agreed as their opinion "that civil aviation as such is of comparatively little value as a possible war armament." But the prepared and material employed in civil aviation constitutes possible war elements of very high value as a result of the ease and regular with which they can be most easily be utilized for certain military purposes." The delegations of France, Italy, and several other states were so immediately in conflict that any discussion of military aviation alone would be illusory, and that the thought of an agreement for the limitation of aerial armaments must include military and civil aviation as an indivisible whole, hanging together. The United States, Germany, the British Empire, and four other countries, on the other hand, were of the opinion that bombing should be considered as military aviation only, if only because of civil aviation is so much more than any combined system. Germany and the United States then went further, but their position might be maintained in the end.

They pointed out that they strongly opposed, and cannot accept, any consideration or taking into account of the present or future of civil aviation as any part proposed for the reduction and limitation of air armaments." There arose a great amount of discussion and finally it was decided that the whole question should be referred to a special committee of civil aviation experts to be charged with the working out of some formula which would avoid against civil aviation bombing as important military factor or preventing the successful development of aviation as a means of military power, of the same time without hindering the normal development of civil and commercial flying. The special committee, on which one member was picked from each of the major states active in commercial aviation and upon which Harry F. Guggenheim was the American member, met at Brussels in the spring of

The road to profit in air transportation leads through reduction of expenses, and particularly of overhead. Messrs. Putnam and Myers, speaking from extended experience in air-transport accounting, conclude that a new load of overhead has been dropped on the shoulders of the air mail contractors in the form of an unduly involved accounting system. They applied the Post Office Department's initiative in requiring uniform accounting, but they ignore the details of the plan and the methods of execution. The subject deserves the closest attention, not only from certified accountants but from all air transport personnel, particularly those who are or expect to be executives.

Accounting for air carriers

A CRITIQUE

A NUMBER of interested persons have from time to time expressed

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containing suggestions and to ascertain costs and results. At this time the government might have insisted that the operators work out some uniform system among themselves, but instead it forced one onto the industry.

Whether system is evolved it should provide the same information that progressive business would seek for itself, in as simple and direct a way as possible. The principles and arrangements should conform to generally accepted commercial practices, and it should be free from the restrictions, complications and consequences that so commonly characterize governmental methods. If the Post Office Department chooses to add a burdensome accounting ship, business cannot prevent it, but when business men handle a craft demanded for the transport of mail and express, how it should be allowed to choose one with the least possible parasitic resistance.

An accounting system for a department store is not borrowed from a manufacturing plant, but is designed by a man with department store experience. With a uniform system unconditionally necessary for air mail operations, should it not have been set up by a group of accountants especially trained in the business? The discipline of the present one, however, was a simple matter, at first, nearly all the work was done many years ago when the Interstate Commerce Commission set up a uniform system for the railroads. The new system was cranked along the lines of the old, deriving only in having new ac-

counts and names on the forms, and with a new sign over the entrance, "Office System of Accounts for Carriers by Air."

Even if carriage by air is only another form of transportation why have an antiquated, expensive system onto a young and growing industry? Only railroad employees know the extra burden involved in using the one that was given them, but it runs into many thousands of dollars a year, and it is a major cause of railroad clerks' notorious productivity. Already some air companies have had to add employees to carry information which is unnecessary and in many cases useless to them.

Informed readers who do not have at hand the Manual and Chart of Accounts can obtain them from the Post Office Department or the Department of Documents at Washington. Their use and scope preclude their being reproduced here, but for readers' assistance in understanding the criticism there is shown a condensed outline of accounts and of report schedules. As to the facility with which the system's extensions are to be followed, let us quote from the Department's introductory letter: "Each entry in each account shall be supported by such detailed information as will enable the classification and verification of the facts recorded therein." A large order! Moreover no account can be destroyed, and they must be kept accessible to the Department's representatives.

The Post Office's Uniform Accounting System was introduced in 1929, the report being mandatory, but the classification optional. But effective July 1, 1938, both must be used. The original edition was mimeographed, the later printed. The present Manual of Instructions is a 140-page pamphlet, dated 1948, and contains names, numbers and definitions of the approximately 200 ac-

counts. The chart is a single, large printed sheet. The annual report is a pamphlet of 23 sheets, 10 1/2 x 16, containing 24 schedules, and closing with an affidavit or confession to be signed by two officers of the respondent. It covers a fiscal year ending June 30, and is to be used for a single air mail route.

The schedules are as shown hereafter, any of them required by accounts which agree in the case with the chart and manual. The classification in condensed form is presented on page 74. A good way of studying the system is to pick out a few specific points in each division of accounts, and they will be taken in the order shown on the chart and as the manual. The numbers involved are those provided in the manual where every line has a numerical designation to permit a sort of checkered reference.

Operating revenues

Many items can be found where the entry may be made correctly in two or more accounts in first step depending wholly on the interpretation made by the individual bookkeeper.

There is no close out distinction between 100-Express Freight and 101-Passenger.

It would be better to discontinue 100-Express Freight and include such revenue in 101-Passenger or in 100-Express and Freight.

Consolidate 100-Other Transportation

into 100-Special Flights and 101-Other Service and transfer from them to other Transportation Group accounts all services that by nature are usually included in 100, 101 and 102-Mail.

For example, when a non-scheduled flight becomes a special one or vice versa? A service is operated between points A and B on regular schedule. A group of persons comes to the airport A to make the trip to B. Although the regular trip is not scheduled to start for another half hour, the group is sufficient to make a full load, and an extra plane is put into service. The risk for the trip is on a mileage basis. The passengers buy their tickets and are at once taken to B. Since the service is not scheduled, the trip can be considered as a charter one. Should it be credited to 101 or 100 (Passenger or Special)? The problem is complicated by the discovery that the Department's manual specifically includes "air" flights under 101, while "charter" flights go under 100. What, an ordinary passenger machine, in the different? Answer: that a scheduled trip, for advertising purposes, decides to travel by air between Chicago and Omaha using the regular service. It has considerable baggage which cannot be carried on the same plane, but which must arrive at Omaha with the group. Inasmuch as the transport company, unknown to the freight, sends an extra plane in Omaha it agrees to

carry the baggage at extra baggage rates. Where is the account for the second plane to be credited? As against baggage, the entry is to 104, but since the second plane is really making a scheduled trip, the revenue can be credited properly to 118. As it might the passenger revenue should be credited to 104, but does party (flying on a regular scheduled trip) is an item as to moments an extra plane to take care of other passengers. The passenger revenue can be credited properly to 119 also. In any event the company bookkeeper must be prepared to justify himself in the Department's traveling auditor.

Parcel Room-125 should be merged with Miscellaneous 127 under Post Office. (Was it thought that the check room might be an outstanding money-order and therefore would detract a place by itself?)

Operating expenses

In addition to part or all of the list of others in the Manual, there are and other employees, Account 131-Supplies, Materials, Maintenance of Field, Structures and Equipment also includes a "Proportionate" part of heating, lighting, telephone service, postage, waste, and other and other supplies. Stationery and Printing, however, are under a separate heading, 127.

Comparison of these items with accounts is interesting. In any ordinary business, one account would "Office Supplies" would include many items as stationery, stationery, paper, glue, ink, pads, pens and rubber bands. In this classification they are listed under accounts 107, 109, 114, 127, all have been labeled Stationery and Printing. Checking into the various equipment shown under the other headings, a "proportionate part" of many of the items mentioned in 131 must also be charged to these other specific accounts. Assume first a company flying the air mail

Typical pages from the Manual of Instructions for the Post Office accounting system.

MAINTENANCE STANDARDS FOR DESIGN

[illegible]

Post-System Change

Season-wise and region-wise total food stock	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05	2105-06	2106-07	2107-08	2108-09	2109-10	2110-11	2111-12	2112-13	2113-14	2114-15	2115-16	2116-17	2117-18	2118-19	2119-20	2120-21	2121-22	2122-23	2123-24	2124-25	2125-26	2126-27	2127-28	2128-29	2129-30	2130-31	2131-32	2132-33	2133-34	2134-35	2135-36	2136-37	2137-38	2138-39	2139-40	2140-41	2141-42	2142-43	2143-44	2144-45	2145-46	2146-47	2147-48	2148-49	2149-50	2150-51	2151-52	2152-53	2153-54	2154-55	2155-56	2156-57	2157-58	2158-59	2159-60	2160-61	2161-62	2162-63	2163-64	2164-65	2165-66	2166-67	2167-68	2168-69	2169-70	2170-71	2171-72	2172-73	2173-74	2174-75	2175-76	2176-77	2177-78	2178-79	2179-80	2180-81	2181-82	2182-83	2183-84	2184-85	2185-86	2186-87	2187-88	2188-89	2189-90	2190-91	2191-92	2192-93	2193-94	2194-95	2195-96	2196-97	2197-98	2198-99	2199-00	2200-01	2201-02	2202-03	2203-04	2204-05	2205-06	2206-07	2207-08	2208-09	2209-10	2210-11	2211-12	2212-13	2213-14	2214-15	2215-16	2216-17	2217-18	2218-19	2219-20	2220-21	2221-22	2222-23	2223-24	2224-25	2225-26	2226-27	2227-28	2228-29	2229-30	2230-31	2231-32	2232-33	2233-34	2234-35	2235-36	2236-37	2237-38	2238-39	2239-40	2240-41	2241-42	2242-43	2243-44	2244-45	2245-46	2246-47	2247-48	2248-49	2249-50	2250-51	2251-52	2252-53	2253-54	2254-55	2255-56	2256-57	2257-58	2258-59	2259-60	2260-61	2261-62	2262-63	2263-64	2264-65	2265-66	2266-67	2267-68	2268-69	2269-70	2270-71	2271-72	2272-73	2273-74	2274-75	2275-76	2276-77	2277-78	2278-79	2279-80	2280-81	2281-82	2282-83	2283-84	2284-85	2285-86	2286-87	2287-88	2288-89	2289-90	2290-91	2291-92	2292-93	2293-94	2294-95	2295-96	2296-97	2297-98	2298-99	2299-00	2300-01	2301-02	2302-03	2303-04	2304-05	2305-06	2306-07	2307-08	2308-09	2309-10	2310-11	2311-12	2312-13	2313-14	2314-15	2315-16	2316-17	2317-18	2318-19	2319-20	2320-21	2321-22	2322-23	2323-24	2324-25	2325-26	2326-27	2327-28	2328-29	2329-30	2330-31	2331-32	2332-33	2333-34	2334-35	2335-36	2336-37	2337-38	2338-39	2339-40	2340-41	2341-42	2342-43	2343-44	2344-45	2345-46	2346-47	2347-48	2348-49	2349-50	2350-51	2351-52	2352-53	2353-54	2354-55	2355-56	2356-57	2357-58	2358-59	2359-60	2360-61	2361-62	2362-63	2363-64	2364-65	2365-66	2366-67	2367-68	2368-69	2369-70	2370-71	2371-72	2372-73	2373-74	2374-75	2375-76	2376-77	2377-78	2378-79	2379-80	2380-81	2381-82	2382-83	2383-84	2384-85	2385-86	2386-87	2387-88	2388-89	2389-90	2390-91	2391-92	2392-93	2393-94	2394-95	2395-96	2396-97	2397-98	2398-99	2399-00	2400-01	2401-02	2402-03	2403-04	2404-05	2405-06	2406-07	2407-08	2408-09	2409-10	2410-11	2411-12	2412-13	2413-14	2414-15	2415-16	2416-17	2417-18	2418-19	2419-20	2420-21	2421-22	2422-23	2423-24	2424-25	2425-26	2426-27	2427-28	2428-29	2429-30	2430-31	2431-32	2432-33	2433-34	2434-35	2435-36	2436-37	2437-38	2438-39	2439-40	2440-41	2441-42	2442-43	2443-44	2444-45	2445-46	2446-47	2447-48	2448-49	2449-50	2450-51	2451-52	2452-53	2453-54	2454-55	2455-56	2456-57	2457-58	2458-59	2459-60	2460-61	2461-62	2462-63	2463-64	2464-65	2465-66	2466-67	2467-68	2468-69	2469-70	2470-71	2471-72	2472-73	2473-74	2474-75	2475-76	2476-77	2477-78	2478-79	2479-80	2480-81	2481-82	2482-83	2483-84	2484-85	2485-86	2486-87	2487-88	2488-89	2489-90	2490-91	2491-92	2492-93	2493-94	2494-95	2495-96	2496-97	2497-98	2498-99	2499-00	2500-01	2501-02	2502-03	2503-04	2504-05	2505-06	2506-07	2507-08	2508-09	2509-10	2510-11	2511-12	2512-13	2513-14	2514-15	2515-16	2516-17	2517-18	2518-19	2519-20	2520-21	2521-22	2522-23	2523-24	2524-25	2525-26	2526-27	2527-28	2528-29	2529-30	2530-31	2531-32	2532-33	2533-34	2534-35	2535-36	2536-37	2537-38	2538-39	2539-40	2540-41	2541-42	2542-43	2543-44	2544-45	2545-46	2546-47	2547-48	2548-49	2549-50	2550-51	2551-52	2552-53	2553-54	2554-55	2555-56	2556-57	2557-58	2558-59	2559-60	2560-61	2561-62	2562-63	2563-64	2564-65	2565-66	2566-67	2567-68	2568-69	2569-70	2570-71	2571-72	2572-73	2573-74	2574-75	2575-76	2576-77	2577-78	2578-79	2579-80	2580-81	2581-82	2582-83	2583-84	2584-85	2585-86	2586-87	2587-88	2588-89	2589-90	2590-91	2591-92	2592-93	2593-94	2594-95	2595-96	2596-97	2597-98	2598-99	2599-00	2600-01	2601-02	2602-03	2603-04	2604-05	2605-06	2606-07	2607-08	2608-09	2609-10	2610-11	2611-12	2612-13	2613-14	2614-15	2615-16	2616-17	2617-18	2618-19	2619-20	2620-21	2621-22	2622-23	2623-24	2624-25	2625-26	2626-27	2627-28	2628-29	2629-30	2630-31	2631-32	2632-33	2633-34	2634-35	2635-36	2636-37	2637-38	2638-39	2639-40	2640-41	2641-42	2642-43	2643-44	2644-45	2645-46	2646-47	2647-48	2648-49	2649-50	2650-51	2651-52	2652-53	2653-54	2654-55	2655-56	2656-57	2657-58	2658-59	2659-60	2660-61	2661-62	2662-63	2663-64	2664-65	2665-66	2666-67	2667-68	2668-69	2669-70	2670-71	2671-72	2672-73	2673-74	2674-75	2675-76	2676-77	2677-78	2678-79	2679-80	2680-81	2681-82	2682-83	2683-84	2684-85	2685-86	2686-87	2687-88	2688-89	2689-90	2690-91	2691-92	2692-93	2693-94	2694-95	2695-96	2696-97	2697-98	2698-99	2699-00	2700-01	2701-02	2702-03	2703-04	2704-05	2705-06	2706-07	2707-08	2708-09	2709-10	2710-11	2711-12	2712-13	2713-14	2714-15	2715-16	2716-17	2717-18	2718-19	2719-20	2720-21	2721-22	2722-23	2723-24	2724-25	2725-26	2726-27	2727-28	2728-29	2729-30	2730-31	2731-32	2732-33	2733-34	2734-35	2735-36	2736-37	2737-38	2738-39	2739-40	2740-41	2741-42	2742-43	2743-44	2744-45	2745-46	2746-47	2747-48	2748-49	2749-50	2750-51	2751-52	2752-53	2753-54	2754-55	2755-56	2756-57	2757-58	2758-59	2759-60	2760-61	2761-62	2762-63	2763-64	2764-65	2765-66	2766-67	2767-68	2768-69	2769-70	2770-71	2771-72	2772-73	2773-74	2774-75	2775-76	2776-77	2777-78	2778-79	2779-80	2780-81	2781-82	2782-83	2783-84	2784-85	2785-86	2786-87	2787-88	2788-89	2789-90	2790-91	2791-92	2792-93	2793-94	2794-95	2795-96	2796-97	2797-98	2798-99	2799-00	2800-01	2801-02	2802-03	2803-04	2804-05	2805-06	2806-07	2807-08	2808-09	2809-10	2810-11	2811-12	2812-13	2813-14	2814-15	2815-16	2816-17	2817-18	2818-19	2819-20	2820-21	2821-22	2822-23	2823-24	2824-25	2825-26	2826-27	2827-28	2828-29	2829-30	2830-31	2831-32	2832-33	2833-34	2834-35	2835-36	2836-37	2837-38	2838-39	2839-40	2840-41	2841-42	2842-43	2843-44	2844-45	2845-46	2846-47	2847-48	2848-49	2849-50	2850-51	2851-52	2852-53	2853-54	2854-55	2855-56	2856-57	2857-58	2858-59	2859-60	2860-61	2861-62	2862-63	2863-64	2864-65	2865-66	2866-67	2867-68	2868-69	2869-70	2870-71	2871-72	2872-73	2873-74	2874-75	2875-76	2876-77	2877-78	2878-79	2879-80	2880-81	2881-82	2882-83	2883-84	2884-85	2885-86	2886-87	2887-88	2888-89	2889-90	2890-91	2891-92	2892-93	2893-94	2894-95	2895-96	2896-97	2897-98	2898-99	2899-00	2900-01	2901-02	2902-03	2903-04	2904-05	2905-06	2906-07	2907-08	2908-09	2909-10	2910-11	2911-12	2912-13	2913-14	2914-15	2915-16	2916-17	2917-18	2918-19	2919-20	2920-21	2921-22	2922-23	2923-24	2924-25	2925-26	2926-27	2927-28	2928-29	2929-30	2930-31	2931-32	2932-33	2933-34	2934-35	2935-36	2936-37	2937-38	2938-39	2939-40	2940-41	2941-42	2942-43	2943-44	2944-45	2945-46	2946-47	2947-48	2948-49	2949-50	2950-51	2951-52	2952-53	2953-54	2954-55	2955-56	2956-57	2957-58	2958-59	2959-60	2960-61	2961-62	2962-63	2963-64	2964-65	2965-66	2966-67	2967-68	2968-69	2969-70	2970-71	2971-72	2972-73	2973-74	2974-75	2975-76	2976-77	2977-78	2978-79	2979-80	2980-81	2981-82	2982-83	2983-84	2984-85	2985-86	2986-87	2987-88	2988-89	2989-90	2990-91	2991-92	2992-93	2993-94	2994-95	2995-96	2996-97	2997-98	2998-99	2999-00	3000-
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Subsampling: Random (see

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Expanding Systems Group

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While tables show the number of cases recorded, and the assessment time (in hours) used recorded, which can be allowed for the percentage of all operations listed in the left for the classes of pieces indicated by the bands. Multiplying the number of units by the time consuming recorded in fractions of hours, allows the assessment which should be allowed for a given job.

A maintenance yardstick for the designer

PART TWO

B₂
Ralph G. Lockwood

IN THE January issue of *Aviation*, I presented the first part of a table intended to assist the designer of a transport a standard against which he may compare the maneuvering characteristics of his machine. The first section of the table is devoted to such common operations as the structure of the turn, the proper turn second and last part being presented in this issue. The second section covers the common types of the power plant, instruments and accessories. Below, the table gives the number even required to do a job, and the handling allowable once to complete it for airplanes of various weight and horsepower.

The second of two articles by the chief engineer of Eastern Air Transport, Inc. is in which the table of allowable time limits for maintenance of transport planes is completed.

ing paragraphs will include a few suggestions as to how some of the problems that vex the maintenance man today may be solved while the plane is still on paper.

Landfill years have always been a problem, both for designers and shop owners. The former is liable to store the 30 to 40 per cent of the original power, which is not used, and the latter is going simply to die as the incinerators go through the air. He is, therefore, much inclined to drop the offending members with all sort of streamlining devices to reduce these losses. The maintenance man, who may never enter either without boots, rain, and auto bearings, rather than sit on his own box, or the painter who the well-meaning designer has told to paint the box, may be asked to spend his day or more on a minor adjustment job that should involve only ten minutes. Short of that,

Taxi shocks and taxi wheels are also a considerable source of trouble. Mechanically, such units are relatively simple, but it should be unnecessary to partly dismantle the tail of an airplane to remove or attach them. Here is a case where the time allowance in the tables may seem unreasonable, but the author is convinced that by making a few simple changes in the

design of the structure, such as bringing all bolts or other connections into the apex, and making the attachments entirely independent of any other fastenings, the repair men's work can be streamlined.

In the average repair shop a good deal of time is wasted in getting the automobile on a jack. The reason for this is that work on the undercarriage can be conveniently done, without endangering the stability of the frame. These same men, however, are not used to working on a universal jack, made on principle so that one found in practically every roadside automobile repair station. It is up to the design engineer, then, to make a vehicle so clearly designed, to make work on the underside of the wing or fenders, *apex* from the vehicle's wheel supports, where the weight can be concentrated, without danger of damage to the structure.

Closely allied to the problem of the undercurrent, but applying also to all mixed or biased films throughout the

airplane, in the proper selection of bearings. It is still common practice to make joints (thrust and rotation) in such places such joints consist simply of a hole drilled through a tube and fitted with a plain and a split plain with a conical nut, or merely a plain nut and key. Bearings of this type require constant lubrication, and even wear the best condition, wear rapidly. It has often been found necessary to cut and replace certain structural members at considerable labor and expense, merely because there was insufficient bearing surface and a worn hole was bad for the nation of a bearing, or for the replacement of a worn pin by a larger one. Designers should make it a general rule that when moving parts are joined together, they be carried either on ball bearings, or on replaceable bearings of malleable material. Whenever possible, however, the use of ball bearings is recommended, for they properly installed they do not require further attention in later years. Where thrust or other bearings are used, suitable provision must be made for lubrication. Some type of high-pressure grease is preferable, and suitable devices must be installed as accessible means for the replacement of grease gun.

Presently all modern airplanes in the transport class are fitted with some form of stallstall adjusting device. The mechanism varies widely in form, but usually requires considerable attention on the part of the maintenance crew. Notwithstanding, this equipment must be located within the baggage proper, but suitable provision must be made both at the tail, and throughout the fuselage for complete accessibility for inspection, lubrication and repair.

Engine adjustments

Referring to the accompanying table that have to do with engine maintenance operations, it will be noted that an airplane has been in excess of 100 hours of the engine itself. The only operations listed here are those which must be carried out with the engine in place in the plane. Much of the difficulty associated with work around engines arises from the fact that the designer usually does not consider the power plant as a whole unit, taking into account such parts as cowling, manifolds, radiators and oil coolers. The engine used is considered in the basic unit, and all other parts become merely accessories to be distributed more or less to suit the designer's fancy, as to its with his plan for the airplane from a purely maintenance point of view.

A few examples of the troubles that are met with in regular shops today will serve to illustrate this point. Removing the piston pins for maintenance is perhaps one of the most common operations required on piston engines, and yet it is necessary in many instances to remove large amounts of cowlings, or to explore into or into blindly with

socket wrenches to get at them. Other structural members of the engine must make it difficult, if not impossible, in such respects, cowling, or other engine parts which must be removed occasionally for adjustment. In many cases maintenance must develop a certain type of talent as technicians to be able to work in power plant installations, an accomplishment that may be coming through, but which certainly does not afford an efficient way to obtain efficiency in the repair shop. It is extremely difficult sometimes to reach into a built-down hole around the base of cylinders or on exhaust manifold. The situation is further complicated by the type of safety locking devices now in use. There is opportunity here for someone to develop a satisfactory safety device which does not involve the stretching of wires through holes in the structure, or the use of bolt heads or nuts equally complicated.

Instruments

Instrument error and omissions have been made standard and unsatisfactory for some time past, but the procedure which must be gone through to connect up the instruments on every airplane is making short work of the wonderful. Other laws are required for installing and making connections which only minutes should be necessary. It is quite impossible to remove and replace instruments within the time limits

shown in the accompanying table if it is necessary to strip all contacts, or to send on every head in order to get at the connections. Quick-acting couplings, maintaining all pressure and vacuum lines, and particularly the development of quick, reasonable means for emergency removal are possible necessities for this situation.

Barriers and radio sets are often needed away to almost impossible locations. Few designers seem to realize that such apparatus in emergency is used all attention and first storage batteries are changed at the end of every day's operation. If the latter point were thoroughly understood there would be little excuse for the necessity of removing charts, sections of flooring, or some permanent upholstery to get at batteries. There is some recent evidence of the maintenance of the instrument panel now have much to be desired.

The suggestion made herein have necessarily been brief and are far from complete. They are, however, to the necessity of closer cooperation between designer and operator, and a better understanding on the part of the owner of the special problems which arise from the practical operation of airplanes in the field. Each airline is not only different, but in the maintenance of a airline are not to operate in an irretrievably sound basis.

Locomotive for the Akron

THE development of airplane has been outstanding in a large extent upon available ground landing equipment. Until recently the moving of a large airplane or its parts has been in any way, but the present writer has acquired the services of a large and recently issued ground unit. The recently developed portable moving unit may be used to relocate the aircraft without difficulty. To supplement the most recent installation of Lakeview, N. J., designed to handle large road airships at the Akron type, the Naval Air Station has purchased and installed a special locomotive designed and built by the W. K. Porter Company, of Pittsburgh. This machine operates on a crawler track around the moving unit, and

is engaged with a coupling beam to which the steel lines of the airship are attached. In this fashion the airship may be moved parallel to the ground.

The machine is powered with an eight-cylinder internal combustion engine connected to the driving wheels through a hydraulic transmission. It weighs 250,000 lb. and has a crawler track of 60,000 ft. in length, giving a ground speed of 100 ft. per min. A coupling beam is also provided which permits a forward travel of about 7 ft. per min. It was reported that the height of the locomotive is not over 6 ft. from the top of the rail and that the top is perfectly smooth, rounded projection at any point which might catch on the airship as it was being moved the moving unit

Alaska needs the airplane

Aircraft are fast becoming vital in the Alaskan economic structure, despite the small population and severe seasonal operation difficulties.

LIKE all areas generally settled, purely supplied with surface transportation, and rich in natural resources, Alaska affords excellent natural opportunities. American interests have recognized this, and, starting with the pioneer efforts of the late Carl Ben Eielson, all-year air services have been provided to the distant, lonely, and remote life. In fact, the airplane has become most indispensable in the economic system of the Territory, thus in many respects of heavy population in the temperate zone. One indication of its importance is the authoritative estimate that about 50 per cent of those who traveled 250 miles or more in Alaska in 1950 did so by air.

The story of aviation in Alaska is a story of expanding the field, which aircraft are most effective and of the adaptation of conventional machines to the severe operating conditions prevailing. Though scheduled passenger and mail services are being expanded and expanded, the major emphasis is on the more profitable charter work. In fact, the general change for an entire party of four is only about \$1.50 per trip, and

Alaskan Airways, a division of American Airways, is one of the leading companies operating within the Territory. This company also operates assignments in the Canadian Yukon and eastern Siberia. Another operating company is Pacific International Airways which bases at Fairbanks, to date the Alaska firm. The only airline between the continental United States and Alaska is operated by Western Hemisphere Airways, started in 1929.



Alaskan Airways alone carried about 1,500 passengers in 1950 and in the single month of April, 1951, carried 14,000 lb. of express or freight. Alaska-Washington Airways carried several thousand passengers, a large quantity of freight, and flew 505 hours in the first five months following its inauguration in 1929. In a general way, the aircraft companies are each slowly but surely expanding, and the 1944 miles of scheduled, the inefficient roads and trails, the slow and relatively expensive dog teams, and the slow boats which ply the Territory's myriad streams, compete valiantly with the airplane for mail points of transportation, the most notable example being the hauling of heavy freight.

An airplane is able to travel as fast as a business which an average dog team would take a week to negotiate, and the cost to the passenger is about the price of the dog team fare. The individual charter cost for an Alaskan Airways plane averages about \$1 per mile. However, this is usually the cost exclusive of the fare. The fare would be around about 30 per cent in case the flying company serves a passenger for the non-chartered part of the trip, and the average charge for an entire party of four is only about \$1.50 per trip, and

Peccol problems

There are a number of operating and maintenance problems peculiar to the Territory. The payload of a plane ready for a flight in winter is always lowered about 150 lb. by the emergency equipment which must be carried. It includes a pair of snow shoes or skis for each seat on the floor, sleeping bags for each person for at least a few days, a complete set of emergency tools for the engine, a lot of repair material—

such as fabric, dog, spark plugs—air mattresses, extra socks and underwear, and so on. All passengers are required to wear suitable outdoor clothing, though the cabin is heated.

The average winter temperature in Alaska ranges from 20 deg. above zero (along the coast) to 20 below, and when an overnight stop is made over some of the regular bases, special provisions must be taken by the pilot to make proper handling of the plane and engine next day. His first job is to get the plane up the place up an edge or lands so they will not freeze in the snow. He then starts his oil quickly into cars carried in the cabin, and places them in the plane. He then starts the engine, and waits for the night. The engine is covered with a huge canvas hood which extends to the ground to form a sort of greenhouse tent. Except in rare situations, the landing is made at some point where there are cabins, repair passengers and others and the pilot is left alone.

The pilot has to be a jack-of-all-trades, and a woodsman as well. He has to be an expert mechanic in his own hands, any kind of engine or plane adjustment, and because of the cost of country he has, he must be well acquainted with the tricks of survival in wild land even on a forced landing or unfavorable flying conditions. He often has to be his own veterinarian. In the morning, after one of these overnight trips, from one to two hours must be spent in getting the engine warmed up and the plane in shape for the next day. First the pilot enters into the engine "bait" and, with five extinguishers in hand, starts the gasoline system on its job of heating the engine. Then he starts the oil pump, and on another engine carried on the plane, or in a local cabin. When the engine

is ready, the oil is quickly poured in and the engine started. On the few occasions when it does not catch before the oil gets cold, the whole procedure is started again from scratch.

Some operations are halted only when the temperature drops below 10° below zero, after weather conditions being favorable, the plane's crew of one man has his difficulties in keeping his seat in running condition. While the engine is being run up, the pilot discharges up to the wing in his heavy fur clothing and brushes the frost from the wing with heavy hair brushes; a cloth is used for the final rubdown.

Arounded engines are used exclusively by Alkon Airways. The low winter temperatures necessitate special cowling features, such as protective glass between cylinders and in front of the carburetor, and extra heavy lagging (jackets) around the oil tanks. The air pump for the carburetor operates in the nose instead of forward, providing a less intense blast of air in the intake, while one lost from the exhaust pipe carries heat to the carburetor and the other carries heat to a colder radiator.

Flies are used exclusively in winter, even on the company's Keystone airplanes. In summer two-thirds of the company's planes are equipped with portulans, the balance with wheels. Regular airports are few and far between, so pilots carry from their bases in summer time one wheel, rudder and steel bar. The latter are constantly being shifted by the swift river currents, and often are submerged, so that great care must be taken in selecting the landing spot. In winter pilots permit landings on very level frozen river of obstruction, and the mobility of the airplane is greatly increased.

Operations are emphasized by the lack of good communications and com-

mutant microwave weather reports. The Army Signal Corps gives excellent communications with no limited facilities, but the very scattered nature of the territory encompasses precludes the standard weather coverage enjoyed in continental United States.

Flying alone on advantage

Alkon Airways has five Fairchild 73's, two Stinsons, one Stinson, a Stinson Junior, a Keystone amphibious and a Travel Air cabin model. Because of the lack of hangars—there are only three in Alaska—the folding wing feature of the Fairchild struck out as a strong economic advantage. It plays a large part, too, when planes are caught in ice severe winds, since the folding wings greatly reduce the danger of their being blown away.

No air mail contracts as such have been arranged for by the United States Post Office Department, but a number of operators have been successful bidders for star route contracts. It is up to the contractor to choose and to provide the equipment needed for carrying this mail, and several may be used as well as dog teams, boats or any of the conventional media. Alkon Airways holds eight of these star route contracts. The company also operates seven scheduled passenger and express services, three of which are weekly, two bi-weekly and two monthly. Frequent trips are made from Nome to the Stewart Peninsula, and to some settlements on the Bering Sea and along the Ketchikan Coast route.

The 605-mile route between Fairbanks and Nome is flown in six days every Tuesday. The fare is \$200 per passenger and the average express rate 75 cents per lb. The express rate per 75 cents increases with the distance flown, the lowest being 20 cents for a 175-mile trip, the highest 75 cents for

a 605-mile trip. On chartered trips the charges are more flexible, and often are influenced downward by competition. Buses are at Nome, Fairbanks and Anchorage. Arthur W. Johnson is vice president and general counsel with headquarters at Fairbanks; J. E. Grooms is operations manager. Fifteen mechanics busy for transport in charge for six pilots to operate. There are agents in fifteen communities.

Twice-weekly schedules

Alaska—Washington Airways has been operating a twice-weekly passenger and express service between Seattle and Sitka during the open months, and has been doing a good deal of charter work. It uses Lockheed Vega on Sitka flights, which are fast enough to cover the 1,000-mile run in 4½ hours. Flights leave Seattle Tuesday and Friday at 8 a.m. arriving at Ketchikan at 2 p.m. and at Sitka two hours later. Southbound trips are made each Sunday and Thursday, Wrangell, Poughkeepsie, Skagway and Sitka are flag stops.

According to this company's most important source of charter operations have been the fishery interests. Inspection trips involving a chain of scattered and small-theater communities are made as far as place around of weeks by other means, while commercial visits to fishing grounds have served to apprehend fish parties, who often come from distant coastal towns.

Like all the Alkon companies, this one has been active in the transportation of passengers and mail, and it has obtained the pilot of the plane stated a chain of his own while at the scene of a new strike. The plane is particularly effective when a new field is opened up, since it enables operators to reach the area much quicker than their rivals who travel around at a time where even a few miles may make all the difference between a distant location and an almost hopeless one.

Planes may be observed in the rate of 500 per hour, or 340 per hour when the contract calls for at least two hours flying. Passenger fare on the Seattle-Sitka service is based on a charge of 10 cents per mile. Plane operations costs are placed at \$10 per hour. Among the special measures provisions is the use of a special treatment worked out by the Lockheed company for application to the physical fatigues and wings as a protection against self-entire action and special bearing of the exterior of the fuselage to withstand the stress of landing and take-off in rough water.

Between March 1 and Nov. 1 of last year the company carried 355 passengers on the Seattle-Sitka service. Between April 1 and May 1 the company's planes in this service operated in southern Alaska were flown 39,328 miles, and carried 3,861 passengers and 8,535 lb. of express

EDITORIALS

AVIATION

EDWARD F. WARNER, Editor

An aviation platform

(Continued from January)

INST month, we started the publication of a general program and prospect, for the aviation industry and all of its associated interests. There was more to be said than could be contained in a single issue, so we carry the platform forward here. We shall carry it forward again, in complete, next month.

Transport

4. Alkon passenger "contracts" on table. The future of air transport depends upon its acceptance by the general public as a perfectly ordinary means of conveyance. Everything that sets it apart, or that makes it look like an adventure, is a barrier to its future prosperity. And among the foremost offenders in this respect is the enormous dedication placed upon the face of an airline ticket, and read and signed by the passenger before leaving the plane, that the company declares itself to be only a private carrier and that it accepts only a limited accident responsibility.

So far as we are aware, no such declaration has yet received any standing in an American court. In at least one case the court has gone out of its way to denounce the contract limitation of responsibility and to declare it completely lacking in force. It apparently has little or no value as a protection, but even if its value were considerable it would be more than counterbalanced by the unfavorable effect upon the mind of the passenger and consequently upon traffic. It is a cumbersome and a little device, but contented, whose actual and proper object is to play safe, wherever even a shadow of doubt exists, are actually to take the initiative in recommending its abandonment. If it is to be abolished, the airlines will have to make the move without waiting for their lawyers' suggestion. At least two of these have already done so—the others will do well to follow their example. Passenger liability should not be corrected by avoiding it, but by insuring against it.

5. Cooperative air express. The handling of inter-line passenger traffic has been enormously improved since it has come to be the rule that all lines entering a city

use the same airport. The passenger can take the suitcase and use his own intelligence in getting out of the plane at the end of the first section of his trip, leaving a ticket for the next section, walking over to another plane and getting in. Express packages unfortunately have no such powers of decision and self-protection. Somebody has to handle them, and if four different organizations do the handling chaos is inevitable.

At the present time a number of the airlines of the United States are co-operating with the Railway Express Agency. A number are co-operating with one or the other of the two great telegraph companies. Several have started their own express services, and run them entirely within their own organizations. Others co-operate with nobody, and make constant lament because their units so ideal organizations for the handling of air express on a national scale.

Unity of handling express matter is the first requisite for the proper growth of air express service. It is indispensable. What organization does the work centers each has that that some organization should be selected to do it. It is for the transport operators to get together and decide on a policy, with unanimous acceptance of whatever course the majority elects. The one essential condition, of course, is that the air express agency should be open to all transport lines on equal terms. It should not even be considered as a competitive weapon. If one group of operators try to form such a service with another group excluded, we shall be back to our present impossible confusion. We believe that the present volume of air express traffic can be multiplied at least by fifty, and perhaps by a hundred or more, within the next few years, but it can only be done through a centralized and completely impartial governing organization.

6. Cooperative air economy. In a certain mid-western city, in the center of the business district, there is a consolidated air ticket office—modern and imposing. Directly across the street, and also handsome and imposing, is the office of an airline, one of those whose tickets the consolidated handles. Two doors further down is another office for another line, and in the next block is a third. We have progressed con-



The engine is covered with a canvas hood which extends to the ground.

admirably since the days when every air transport company felt it necessary to create and maintain its own airport at every stop, but there still is a dual too much individuality. The passion for independence for its own sake has not yet been brought under full control. Common airports and common passenger terminals and waiting rooms are now general practice. It is equally obvious that ticket offices, and passenger buses, and the personnel concerned with handling passengers and goods at airports, should be shared. It is not only obvious, but it is necessary in the interest of that economy which is the fundamental condition of air transport's survival. There is no mystery about the things that passenger transport needs to make it as unqualified success. First among them is an increase of traffic. Among the means of means to that end is a reduction of rates. Rates depend on operating costs. Direct operating expenses have been brought out to the minimum possible with present types of equipment. Reductions can most easily be effected on traffic solicitation and general overhead expense. They can often be made there by replacing several individual organizations or activities with a single centralized one. It ought to be done.

7. **Work on the reduction of rates.** It is hardly necessary for us to elaborate on this topic. It explains itself. When everything possible has been said of fare and fare, alternative means between which the blame for unsatisfactory traffic returns has always been distributed, there remain other factors that keep some people off the airlines and account for some loss of irreplaceable traffic on the part of former passengers. Foremost among them is noise. We feel confident that if the noise in an airplane could be reduced to the level of that in a motor bus, for example, no other change or sign of progress would be required to insure the doubling of the traffic within a year. The airlines have much to atone in the problem, too much for them to risk sitting back and waiting for George to do it (George in this case being the Bureau of Standards) or simply hoping that something will come up. They must lead the way. They must lead by mobilizing their willingness to cooperate in research, and by as absolute insistence that new equipment still show marked progress in noise reduction in the passenger compartment.

8. **Stop talking about blood drops.** Don't stop working on it. Not by any means. The limitless importance of research and development in that field goes without saying. The stop talking about it publicly.

This is a particular manifestation of the general rejection to quit living in the future. Numerous enthusiasts have arisen to inform the public, at various times in the past three years, that airlines will very shortly be able to operate in absolute disregard of weather. A particular member of the public, having been so informed, comes down to the airport on what looks to his untrained eye like a perfectly good day

with nothing more than a little haze or mist, and is told that all trips have been cancelled. *Net result*—another member of the community is convinced that everything said about air transport is unworkable.

Business progress has actually been made in the last few years, and many pilots are now flying, as a daily commonplace, in weather which would have been unthinkable in 1937. At least in passenger operations, however, blood flying is still very much in the developmental stage. We still consumed more public confidence if we kept quiet about that, and other new developments in prospect, until they have approached reliability and been brought into ordinary commercial employment. If we are to take the man who is just considering making a trip west work or next month, and make him not only a one-time passenger but a satisfied and enthusiastic customer, eager to repeat the experience, we must do it by selling him on what air transport can definitely accomplish now, not on what we may believe that it will be able to accomplish in 1955.

Manufacturing

1. **Live within our means.** A large part of the airplane industry has been spell-bound by Mr. Henry Ford and his well-known policy of setting a price and then letting the market grow to fit it. For the present, that method does not appear to work with airplanes. One must be the much less pleasant but, also, the much less hazardous course of estimating the amount of business available and then setting prices and cutting overhead to correspond. An industrial enterprise with a vast and rapidly growing production not only tolerates, but actually needs, a complicated supervisory organization and a large body of executives. For a business of one-tenth the size the same business structure becomes an unbearable burden, as shown as a drum major's bewilderment on the head of a school boy. Small commercial airplane factories do not operate by remote control by push-buttons. Living within our means in 1937 may involve the abandonment of a great many unnecessarily decorated offices, and the sacrifice of some of the lovely gadgets without which life seemed unthinkable in 1939. It may involve substantial cuts in that part of the payroll and salary roll which is not absolutely directly productive. We have gone far along that road in the past two years, but some of us have not yet traveled it to the incalculable end.

2. **Make the product fit the market.** There are in the United States a few dozen divisions of airplane manufacturing companies and a few thousand professional pilots and operators—many of them with military or naval flying experience. They, their ideas on semi-mechanical custom, and particularly their ideal of what an airplane should be, are in no sense typical of the great body of their fellow-countrymen among whom lies the great potential market for aircraft. In too many cases an airplane intended for sale to business

men and operators with no professional flying experience has been designed to meet the taste of some sort of accident who was president, general manager, or chief engineer of the responsible company. In less extreme instances planes are still being produced to a specification based on the official's own preference in craft for their own cross-country travel.

Personal preference of those in the business may be a useful preliminary guide, but it can be nothing more. Not long ago, when a great New York department store was planning a series of special sales it resorted to the drastic process of questioning 20,000 women on their tastes and desires and striking an average through the aggregate of their replies. It may not be necessary, or even useful, to apply the questionnaire method in developing airplanes, but such the same result must be obtained. A new product has to be aimed at a specific market, and a specific type of person should be in mind as representing that market. The product has to be analyzed from his point of view. His limited competence, his limited knowledge, and his miscellaneous prejudices must be taken into account. The prejudices might be overcome, in some cases, by sufficiently persistent argument, but the limitations are as established facts that must be accepted. Since the customer will not fit himself to the plane, the plane must fit the customer. Altogether too seldom is there evidence of conscious effort to make it do so. To make a plane as hazardous that only a few hundred people can afford to buy and maintain it, or as difficult to fly that only a real transport pilot can be treated with it, and then expect to sell it in terms of thousands is as foolish as to go into quantity production on dining-room furniture sold by Singer's Widgets and expect that normal-sized housewives will cut themselves down to the proper dimensions to use it.

3. **Control production of the means.** In 1939 we had a fearful dose of over-production. We are still suffering for our economic ills of that period, but we have complicated them by expansion. The lesson of 1939 was only partly learned. Each of the next two years saw serious types pushed into production beyond any probable sale. Whatever other factors of the depression may be beyond our grasp, we should at least be able to cope with that one.

The airline is production control is of course the formation of an agreement of control type, with each manufacturer accepting a quota based on his past performance and the capacity of his plant. The possibility of so rigid a limitation is sensitive, even in time of desperate economic emergency, is highly questionable. Its unobtainability is almost beyond question. It would be far more difficult to agree upon and maintain production quota in a young industry, of comparatively small size and in an extremely fluid and flexible state, than to do the same thing with a long-established industrial giant. The card method would

work far better upon the automobile than upon the airplane. Positive control or limitation is not to be sought.

But we need not despair of greatly improving the present situation, one of grossly diminishing the choice of any recurrence of an extreme imbalance between production and consumption. A truly first-class statistical service on production and sales would go far to solve the problem.

The Chamber of Commerce does what it can as present, and periodically, several weeks later, it sends out reports on a month's production. Only total figures are given, the individual returns being jealously guarded as confidential. Never was there less excuse for secrecy. No individual manufacturer can make his current plans with intelligence unless he knows what the industry as a whole is doing and where it is being done. Production reports ought to be made weekly by every manufacturer, and made within 48 hours of the end of the week to which they relate. They ought to include not only a statement of the number of planes finished, but also of the number of factory employees, of the number of machines in process of assembly, and of the number for which parts have been or are being fabricated. They ought to include the record of shipments from factory to dealers or distributors and a separate record of current sales to ultimate consumers, with an indication of how many of the final purchasers are private owners, how many aerial service operators, and so on. The builders of automobiles, through the National Automobile Chamber of Commerce, have long been making periodic accounts of full weekly production reports. For the builders of airplanes to refuse to do likewise imparts an unnecessary handicap on every one of them.

(To be continued in March)

More about buying military airplanes

THE general methods used by the Army Air Corps and the Naval Bureau of Aeronautics in getting out new designs are the result of long, hard, and varied experience. They are the final outcome of a series of trials of a series of devices, of varying merit. Some of the schemes that have been tried, either at the volition of the services or under pressure from Congress, and subsequently dropped have had virtually no ascertainable merits whatever.

A practice in which we could see but little virtue, for example, was the maintenance by the Army and Navy of complete design staffs and organizations for experimental development and construction. It was

crew of seven over the route, probably the largest number of persons ever required on a single plane on scheduled service. A third Copper, to be ready by July 1, has been ordered by P.A.A. from Sikorsky Aircraft.

Lufthansa reports on 1931

Lufthansa planes were flown only 5,438,584 miles during 1931, a decrease of 7.6 per cent over 1930 mileage. The drop was due to discontinuation of a number of poorly patronized domestic lines and the dropping of the Berlin-Stockholm service. A special effort was made to improve the other internal lines and the international operations, most of which are worked in cooperation with airlines of other countries.

Lufthansa passenger traffic increased, largely on account of reduction of rates to approximately 6 cents per mile on both domestic and international lines. Exports continued to increase, 1931 volume 26 per cent over 1930 and 25 per cent over that of 1929. Mail fell off most of the decrease caused by the starting of newspaper shipments. Following an American example, the company operated with much success a high-frequency service (five times daily in each direction) between Philadelphia and Cologne during the summer months.

Forced landings have decreased from 174 in 1928 and 75 in 1929 to 41 in 1931, not including water service Cessna's landings, standing at the astonishing total of 32 in 1928, when no contract in 1930. Following the lead of American firms, Lufthansa is endeavoring to introduce later equipment in its service.

Another English experimental air mail flight was completed late in December, by Air Commerce Knapford-South. One of the two machines flying to deliver Christmas and evoked smiles.

American Airways has introduced an innovation in the shape of a business

Taxiing Passenger Bus, a traffic department specializing in coordinating members to the best advantage of business men.

The Ford air freight service is set to start Sunday between Detroit and Chicago and Cleveland.

The latest development in the drive by State of Washington interest to have the government build a northern transcontinental airway to Seattle across North Dakota and Montana is the report by the American Branch of the survey made last summer, under terms of a special \$50,000 Congressional appropriation. The Department reports that the airway would cost between \$384,500 and \$449,750 and would be 1,576 to 1,582 miles long, depending upon the route chosen. No recommendations were made. The possibility that the survey campaign commenced shortly by Senator Dale, of Washington, might succeed, has caused little groups in private letters, but the two federal agencies in their state are abandoned in favor of the transcontinental project.

Legal decisions

The material submitted following, together with references to legal authorities elsewhere in the same issue, is based largely upon the Aviation Law Service prepared by the Commercial Council of the American Airline Association, and is of the service, and is to be able to advise the benefits of the work of an organization, and is to be able to advise the benefits of the work of an organization, and is to be able to advise the benefits of the work of an organization.

Principally with the opening of the new Canadian, Senator Brainerd, of New Mexico introduced his bill to turn air commerce, including the issuance of certificates of necessity and convenience for airlines, over to the Interstate Commerce Commission. Its appearance has become an annual event, and although there is perhaps a little more substance

in it than there was in previous years, it seems unlikely to pass.

Failing the passage of the Brainerd Bill as anything like its federal control of air transport is confined to regulation of the interest in April, 1932, but of the state laws, some further, appearing state and requiring that each law secure a certificate of necessity and necessity for operation within the state. The Illinois Commerce Commission, for example, has been given power over air transport within that state, and is planning for the coming spring a conference with all operators to reach an understanding on the method and scope of regulation. In the meantime, accidents for interstate operation have been issued to Century Air Lines, American Airways, and National Air Transport. Illinois is one of the states, and of the most of the Midwest to require an ultimate certificate.

Any plans for state control of aviation in Alabama have been temporarily shelved by the request of the governor to approve the \$12,000 appropriation for the work of the Aviation Commission.

Court decisions conflicting

Development of the law of responsibility for injury in aircraft crashes, both here and in Europe. The French courts have been much more generous to the air transport companies than those of the United States, a recent decision in Paris being upheld the validity of the contract printed as passenger tickets by which air transport companies seek to relieve themselves of responsibility. The American Supreme Court has said for having, by negligence and by default of the airline, the death of a passenger.

The company held that the dead passenger could not have been known, that it was a matter of fact that the airline had no responsibility, and that in any case they had released themselves by negligence from the death of the passenger. The courts supported the company's claim. A recent decision in the United States went exactly the other way on a very similar point, the opinion of the court holding that the "contract" signed by the passenger as an assent to the purchase of his ticket could have no force in relieving the transport company of any responsibility that it would otherwise bear.

How low on the subject is in the making in the United States, for a suit for \$100,000 has been filed against Bristol Airways in the Kansas City Circuit Court by the parents of a girl killed in a recent crash. Another case already decided against the aircraft operator, is being reopened as appeal.

Survivor growing out of the crash, in March, 1931, of a Golden Western plane used for carrying passengers at Newark Airport, decided some months ago with heavy damages for the families



NAVY AT MIAMI

A heavy bombardier over the straits of the Florida Air Force, Naval Air Station, Miami.

of the disaster, say being reviewed by the New Jersey Supreme Court. Governor Charles, of New Jersey, has called on the legislature to take the most serious of the legislature will use an effort to fix the liability of airlines, making it equal to that of railroads under the same circumstances.

In a case in the Federal District Court in Tennessee, the court looked more favorably upon the anti-technical provisions in an insurance policy than has been common in recent decisions on similar points. Several courts have held in the last two years that a clause denying benefits to the holder of a policy in case of death or injury while "engaged in avocations" does not affect the policyholder's travel as a passenger in an airplane. In this case the phrase was modified to prohibit "participation in avocational operations," and the claim was made on behalf of the family of an officer of an air service company, who had been killed while riding as a passenger in one of his company's own planes. The court held that he was a passenger in the eyes of the law, and that that constituted "participation" and relieved the company of its responsibility.

The court decision in the case of the death of a passenger in a biplane, which was held by the court to be a passenger in the eyes of the law, and that that constituted "participation" and relieved the company of its responsibility.

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The O'Donnell case

Two companies discussed in the past month resulted in an accident to one of the planes owned by Lloyd O'Donnell, well-known racing pilot and operator of Long Beach, Cal. The accident was a collision in the air in which O'Donnell's

plane, flown by one of his employees, was struck by the machine with which it was then colliding. The collision was directly above the airport, and the pilot of the other plane mentioned that he was on the point of landing. The judge in the lower court instructed the jury that plane engaged in landing had an absolute right of way under a city ordinance, and that if O'Donnell's plane was actually behind and above the other, and if the other was actually in the course of making a landing, that in itself constituted negligence. A judge in the higher court reversed the decision, holding the instruction to the jury to be improper in that it neglected the possibility of negligence by the other pilot. The court held that there might have been in the course of landing and yet changed his mind and changed his course in such a way as to make a collision inevitable. That he (O'Donnell) could have the pilot of a higher plane taken a false sense of security and thus without warning project himself in the exact line of flight of the other plane, and his act, in so doing, not be called into question, is a conclusion very much doubtful.

In the other case in the past proceeding, a suit for personal injuries brought by the passenger in the O'Donnell plane, the court followed the same line of error in holding a building commercial air operation to be of a common-carrier nature. He then reversed the common-carrier category out of the air transport field to include such local passenger carrying as O'Donnell was engaged in. Nevertheless the judgment for the passenger against O'Donnell was reversed again on the ground that the lower court had failed to take into account the possibility of contributory negligence by the pilot of the other plane.

Another view of another personally

reversed battle was fought in New Mexico, where the State Supreme Court held a state law on the sale of gasoline legal, even though the gasoline was sold for use in commercial air transport. The company involved was Transcontinental & Western Air.

Legal steps in Canada

The distinction between interstate and intrastate commerce is much less definite in Canada than in the United States. The authority of the Dominion is less sharply circumscribed by the terms of the federal government of Washington, and its position has recently been confirmed by the decision of the Privy Council, the supreme court of the British Empire. The Supreme Court of Canada had held about a year ago, on complaint from the Province of Quebec, that the separate provinces had authority over commercial operations within their own boundaries. Privy Council held otherwise, and put the position of the Dominion government as the sole authority over Canadian aviation law.

The Canadian decision is part of a series of decisions by the Canadian of the International Convention for Air Navigation, and the consequent necessity of having a central organ in which that treaty obligations might be observed. About the same time Prince Bismarck, president of the P. A. 1, tried to control international aviation in aviation to an unprecedented degree. At a Bismarck conference he urged that all international associations which concerned themselves with aviation, and questions of aviation, should be placed under a central bureau. It would include purely governmental agencies such as the International Commission for the Investigation of Aircraft Accidents, and the International Commission of Experts on Air Law, purely commercial ones such as the International Air Transport Association, and purely private air sporting organizations such as the F. A. 1. Action upon Prince Bismarck's far-reaching proposal was postponed to give consideration to the matter.

The usual flood of bills introduced by the Army Air Corps and naval aviation attended the opening of Congress. Among them were bills for the reorganization of the Army Air Corps, and the reorganization of the Army Air Corps, and the reorganization of the Army Air Corps.

Another veteran of the congressional mill is the bill to amend the technical provisions of the O'Donnell case, which was introduced by the Air Corps' great pilot at Wright Field, to be used for the benefit of commercial aviation. At the present time the bill is in the hands of the military department at Wright Field.

FLYING EQUIPMENT

Direct fuel injection
for the Hornet

ANNOUINCING has recently been made by the Pratt & Whitney Aircraft Company of certain modifications in a standard Hornet engine to permit the direct injection of fuel into the cylinders, eliminating carburetors, pre-heaters, and hot spots.

The major change in the engine consists of the replacement of the standard carburetor front section by one which contains a series of radial cam-driven fuel pumps, one for each cylinder. Beside the main driving cam, a stop cam is provided which controls the length of strokes of the individual pumps. This mechanism is actuated through a butterfly air valve which replaces the standard carburetor on the air induction system. The linkage between the pump and the air valve is so arranged that proper prepositioning of air and fuel may be had at all speeds from idle to full throttle. The connection in the engine is such that the pilot's controls are similar to standard carburetor throttle control. Mixture and spark plugs are used as in the conventional engine, and the spark controls are located in the usual manner.

Fuel injection nozzles of simple form are located in the front of each cylinder head immediately above the spark plugs. Each is connected to its own pump by means of a steel pipe. By distributing the fuel to the pump, a standard low pressure pump similar to the one used with a carburetor, and located in the same location, is used. Fuel is delivered to a circular manifold connected to the individual fuel pressure pump cylinders through suitable runners. Excess fuel is carried away through a relief valve at the top of the manifold and returned directly to the main fuel tank at the airplane.

For flight testing, an engine of this type has been installed in a standard



Front view of new Hornet

Boeing 40-B mail plane to be flown on regular service on the Boeing Division of the United Airlines.

Curtiss-Wright
Duckling

ABOUT a year ago the Curtiss-Wright Aircraft Company at St. Louis, began production on a three-cylinder, two-stroke light engine, designated as the Curtiss-Wright Duckling. The machine was designed primarily as a boat plane, although during the late summer of 1951, it was flown successfully as a seaplane mounted on Edo floats (Aircraft, November, 1951, page 511).

A modification of the original design has recently been made to turn the seaplane into a light amphibian. In appearance, the new plane has a very strong resemblance to the original plane, the only difference immediately apparent being the addition of a pair

of wing floats suspended from the wing struts and a modification in the tail section. The stabilizer and elevator have been raised, and some wires added to the fin. The underpinning of the landing gear has been made upwardly by a combined use of plywood, fabric and a special waterproof glue, and its frame changed to give the V bottom and steps necessary for suitable water running characteristics.

The air wheels of the retractable landing gear are mounted on simple crank-like struts which swing upward in the rear to withdraw the wheels from the water. As with the original Junior, no shock absorbing devices are necessary, other than the wheels themselves.

The original engine and propeller arrangement have been retained, but a larger power plant has been installed to take care of the additional weight and performance in an amphibian. In the experimental model a Lambert five-cylinder radial air-cooled engine of 60 hp. has been employed, but it is regarded that a 110-hp. Warner engine will be found on the production model. The design is set up in the experimental stage, pending tests for A.T.C.

Stratman
Senior Speedmail

THE Stratman Aircraft Company of Chicago, Illinois, has recently announced the design of a new model designed specifically to meet the requirements of contract air mail operators. The machine is an open cockpit, single

adjustable bendable under the engine practically runs and shut propeller, and ventilators and radiator intakes are installed in regular equipment. Control seats have been made of the layout of the instrument panel, and its lighting.

Standard equipment includes all required navigational instruments such as the Sperry-Hess, Janssen rate of climb sensor, altimeter, and air speed indicator, Ryan retractable landing lights, Wiley John, Hipsy star, and Western Electric air streaming radio equipment are also furnished.

Alternate power plant installations are offered, the model 40B-1 being powered with a Pratt & Whitney Junior at 300 hp. and the 40B-1 would powered with a Wright Whirlwind 275 of equal horsepower. General characteristics of both models are: span, 36 ft., length overall, 36 ft. 11 in., height overall, 19 ft. 2 in.; wing area, 365 sq ft.; weight empty, 2,655 lb.; gross weight, 4,065 lb.; wing loading, 11.25 lb. per sq ft.; power loading, 13.5 lb. per hp.

Boeing Totem
flying boat

ALONG the rugged coast of British Columbia several have been highly rated for fishery and forestry patrol, mining and prospecting operations, and for many other uses connected with the development of the natural re-

sources of the country. Operating conditions are very severe, however, and machines are often away from their bases for several months at a time. Maintenance work must often be done by the pilot and conducted with very limited facilities. Airplanes for such service need to be designed for simplicity of construction, accessibility of parts, and with sufficient ruggedness to withstand a certain amount of rough handling and exposure to the severest weather conditions.

To meet these requirements, the Boeing Aircraft Company of Canada has designed a flying boat of the latter type for four people. It is a pusher type monoplane with a single Pratt & Whitney Wasp Junior engine of 300 hp. mounted in a nacelle over the center of the hull. The latter is of conventional design and is constructed of aluminum sheets over a duralumin frame. It is divided longitudinally into six compartments by five watertight bulkheads. The cabin is located forward of the float spar well out of the way of the propeller.

The wings are of composite construction with wooden spars. Ribs, leading and trailing edges, and other small parts are of chrome molybdenum steel tubing, spot welded. Fuselage, stabilizer and elevators are also of welded steel tubing. In order to remove the possibility of salt water corrosion stainless steel has been used in all wing and tail fittings, wing flap fittings, tail fittings, etc., and in all bolting, nuts and washers. All surfaces are fabric covered. Controls are the standard dual type, and are

(including floats), 310 sq ft.; weight empty, 2,780 lb.; gross weight, 3,300 lb.; gross weight, 4,000 lb.; wing loading, 12.9 lb. per sq ft.; power loading, 13.5 lb. per hp.

Brown Metalark
sport plane

A NEW single, or two-place low wing sport monoplane of all-metal construction has been completed and test flown by the Brown Metalark Company, Saco, Wash. The Metalark is powered with a 90-hp. American Curtiss engine but is stressed for engines up to 170 hp. With a span of 36 ft. and a weight empty of 2,025 lb., the plane is believed to be the smallest all-metal plane that has yet been developed in this country.

The Metalark depicts in its smooth clean monocoque design, of circular cross section, is assembled from seven transverse pieces which are joined by ten lateral bulkheads and eight wing webbed members of formed duralumin. The wing is of three-part, cantilever construction, with a conventional inverted Alula cover. No ribs are employed in the wing, the skin taking the loads. The corrugated covering of wing and tail surfaces is formed from the Alula cover sheet to a special design. All fabrications throughout the plane are by riveting, except where welded steel tubing is used in the landing gear and engine mount, and in stabilizer and all tail member connections. All covered surfaces are finished in hot bearings. Airframe of Prime type are operated by torque tubes, elevators by push-pull rods, and rudder by wire cables which employ pulleys.

This wing is built in three sections, the two tip sections being quickly detachable from the center section which is built integral with the fuselage. The landing gear is installed by means of ground wire and piano type hinge joints and ball joints at the front gear. It is built in four sections, two in each outer wing section, and any section of the landing gear may be readily detached from the wing for inspection of the interior.

The landing gear makes use of Friction rollers (two in comparison with steel wheels) and wheels are fitted by formed dural alloy which mount to the axle and extend to rest on each wheel to produce a stress-strut effect.

Specifications are as follows: Span, 26 ft. 1 in.; length, 30 ft. 7 in.; height, 7 ft. 6 in.; wing area, 308 sq ft.; weight empty, 2,015 lb.; useful load, 1,000 lb.; wing loading, 12.57 lb. per sq ft.; power loading, 13.5 lb. per hp.

Stratman
Senior
SpeedmailThe Curtiss-Wright
Duckling

connected to their respective surfaces by steel push and pull rods.

One interesting feature is the water rudder designed to assist in control when turning. It is designed to be fully retractable into the lower edge of the air rudder, and is so arranged on a hinge that should it strike an object while moving on the water, it automatically folds up, driving again into position when the obstacle is passed. It is operated by a cable control from the cabin.

The general performance are: Length overall, 32 ft. 9 in.; height overall, 11 ft. 2 in.; span, 46 ft.; wing area,

lay layout of conventional design, but the details of arrangement of instruments and equipment have been carefully studied for the particular purpose for which the machine was designed. Particular attention has been paid to the matter of pilot's vision. A large shallow pond glass windshield and an

AIRCRAFT AT WORK

Fresh fish flown
to Fresno market

A SUBSTANTIAL catch of fish has been flown to Fresno, Calif., for marketing, but stock in trade from San Francisco is on the same day it is caught. The 120 crates between Fresno and the Coast may be covered by plane in about an hour and a quarter, or special truck in one hour. There is no extra service. Males can carry a net load of 430 lb. as an C-47, Travel Air or Beechcraft. Other methods of transporting fish involve a delay of at least a day and a half between catch and consumer.

Fish are flown in to Fresno three times a week and the crates are made up in accordance with orders received the day before a scheduled trip. Orders are indicated almost entirely by telephone, either to San Francisco or in the late afternoon and are filed in that city the next day. Two loads make a specialty of filling the orders from their own operations early in the day of delivery.

The fish are packed in boxes for shipment and so often is reversed because the flight is a short one and at a high altitude. In case of a forced landing an emergency supply of air is used. Flights are made twice a week, Wednesday, Thursday and Friday, and the average weekly load for eight months has been

1,200 lb. Delivery to customers' homes is by motorcycle or automobile. The retail price is about 5 cents per lb. higher than for fish transported by conventional ways. The business has been a success.

Doctor uses planes
twelve years in work

EVER since the war Dr. Frank A. Brewer of Denver City, Neb., has made contact use of aircraft in conducting his neurological practice. He has owned twelve planes, starting with a Jenny of war vintage, and now owns a McCulloch. He is a licensed pilot and still does considerable piloting but at the present time employs a pilot mechanic, chiefly to a mechanic to conserve his energy for his work. His territory covers about 300 sq. mi., the flat terrain of Nebraska making close contact with patients possible without resorting to airports.

The airplane enables him to keep in touch not only with the neurologists and outlying farm and oil field homes, but also with his two hospitals at Holdrege and Okecho, Kan., a distance of about 115 miles as the crow flies. He has done the home of a patient he was about to visit for the first time identified for him from the air by a white smoke trail to a windmill.

Operating cost of the private ma-

chine is placed by the doctor at \$16 per hour, or about 14 cents per mile. That charge covers all items, including overhead. His pilot mechanic receives \$19 a week, less pay and is allowed from \$2 to \$6 per week traveling expense. He formerly operated an Arrow Sport which he reports cost him \$4,650 per hour (\$7 cents per mile) for all main stage pilot's salary.

Doctor Brewer considers himself indispensable in carrying on his practice. He believes that doctors may save about 25 per cent in traveling expenses, not to mention time recovered, by using a light craft in preference to any other type of transportation. If they operate in territory such as the Mid-West where landing places are readily available.

Parker Pen plane
makes tour of Europe

A VERY successful sales promotion effort was carried out recently with a De Havilland Twin Otter operated by the Parker Pen Company, Ltd., of London, a subsidiary of the Parker Pen Company of Jamaica, Wm. The machine was flown through fourteen countries of central and southwestern Europe and was landed at 50 airports and fields. It covered 26,000 miles at a cost of 3 cents per mile. This included fuel, oil, baggage, meals, landing fees, pilot and plane insurance, expenses of pilot and depreciation of the plane.

The name Parker Daedalus was painted on large letters on both sides of the fuselage. On one side appeared a large reproduction of the Parker pen and on the other side a reproduction of the pencil. These decorations appeared conspicuously in the thousands of photographs made at the various stops. One news newspaper space was obtained and the campaign attracted much attention

AIRPORT MANAGEMENT

Small airport inn
operated at profit

SINGLE AIRWAYS has been operating profitably a small inn at its Ukiah Airport, Ukiah, Neb. The room is small and compactly arranged to provide an attractive and economically efficient sleeping place. It is a rebuilt guesthouse formerly located near the airport and made available at a small cost. It is used by employees on the field, and by pilots and passengers passing through. It was found to be almost an indispensable convenience and so far has produced a small profit each month.

Two young women do the cooking. About 20 customers are served daily, the savings resulting between others and exclusive dining. Prices are moderate, the specials costing 40 cents, sandwiches 15 cents, omelets and pie 14 cents. Features may be added at one

point of a new machine. Another color is used for the price of the last machine leaves to be sold. These other color changes between the color prices in various states, in the west, and by the California-Dodge company itself.

Two methods of
handling snow

METHODS of snow treatment are almost a major problem at many airports in the North.

At Fresno (Meb.) Municipal Airport the policy has been to push the snow down to provide a mild landing surface rather than to remove it. In the

winter at 1955-1959 two Pioneer tractors with extra wide blades were used with excellent results to break the crust which formed after several severe snow storms which were followed by rain. The next year a large roller commenced at day field of two cable reels with a 2-in. iron pipe for an axle was used with rapid rotation. Power was supplied by a Caterpillar 30 tractor costing the airport \$8 per hour.

The Redwood (S.V.) Municipal Airport was the first in the state to be opened up after a severe snow storm a season ago. A Caterpillar 60 with Waukesha plow was used to remove snow from the runway, which is 250 ft. wide, and a model 11 with Sargent plow applied the finishing touches.



Recovering snow from runway of Redwood (N.Y.) airport. Left: The role on Gates airport, Fresno, Neb., operated by single Airways. Below: California-Dodge contract kept for most plane jobs.

most, right at the two tables and six at the corner. The installation is an excellent example of how good food may be attractively served at a hotel at an average commercial airport.

Control board aids
used plane dealers

A REFINEMENT in methods of handling used plane sales has been introduced at Grand Central Air Terminal, Glendale, Cal., where the Chebros-Dodge concern has introduced a stock exchange type of listing board for quoting prices asked for available aircraft. These prices are entered in the column headed by the status and model of various makes. One other column is used to indicate the current



Parker Pen

The Parker Pen plane which landed Kansas, Missouri, immediately enroute to the most product, in Tompkins' flight. The plane is a Beechcraft or the control of the plane.



SERVICING SHORT CUTS

A chuck for ring grinding

A METHOD of ring grinding pattern rings has been developed in the Oakland shops of the Pacific Air Transport division of United Air Lines by the use of which approximately eight hours of labor time is saved on every set of piston rings milled. The heart of the new method is a lathe chuck which is very accurately turned for each size of ring. This tool is a flat disk with as least as the face of exactly the same size as the engine cylinder into which the ring will fit. A slot across the rim of this disk permits automatic adjustment to be made in determining where the ring has been ground to proper dimensions.

In the P.A.T. shop this chuck is used on a Monarch lathe of taper bearing type and the grinding is done with a Diamond electric grinder. The use of a taper bearing lathe is vital to the success of this method as no end play whatever can be tolerated.

Valve spring testing machine

A SIMPLIFIED valve spring testing device has been developed in the Oakland shops of the Pacific Air Transport division of United Air Lines, which saves an appreciable percentage of the time required to test these loads. A vertical hollow tube is provided with



Pan American's servicing platform

an open chamber near the upper end into which the spring under test is placed. Above this chamber is a weight, movable upward but normally at rest, and below it is a support for the valve spring with a rod extending to a foot operated lever. Foot pressure raises the rod against the spring to a predetermined point. This action in turn causes the spring against the lever weight which is lifted from its seat so that its whole mass is directly supported by the spring. A scale indicates the spring has reached the correct load.

Dozens of known weight sets are used to load the various valve springs, the weights used varying from a total of 30 to 75 lb. in testing the four and eight valve springs of Wasp and Hornet engines. Deflection ranges from 7/8 to 1 in. All weights and deflections are noted by the machine microindicator and are rapidly altered by means of a control.

A simple wheel jack

A NUMBER of German airplane factories and repair shops make use of the device shown in one of the accompanying illustrations when servicing wheels or tires, or for raising the wheels clear of the ground which as airplane is to be stored for any great length of time. The rack is easily constructed of commonly found materials, and is light enough to be readily portable. It provides a firm base for the wheel when in use, and occupies very little space when out of service. It involves few mechanical details to get out of order.

Servicing platform for the Clippers

FOR convenience in servicing the four-bladed propellers of the Clipper type Sikorsky flying boats now in the South American service, the Island servicing shops of Pan American Airways, Inc. have developed a portable scaffolding. The main part of the structure is of wood and stands taking and supports a wooden platform approximately 15 ft from the boat. The platform is raised on three poles and the work basket, small tools and supplies, as well as fuel for lighting equipment are provided. Small trap-doors in the floor permit the swinging of the propellers for valve adjustment.

Eliminating fluctuation from climb indicators

IN some airplanes, particularly of the cabin type, difficulty is sometimes experienced with the rate-of-climb indicator, caused by fluctuation of the pointer immediately following a change of altitude. The most common trouble is a temporary "dip" or "submergence" of short duration, when the plane is put into a climb, or a momentary "up" indication if a window is opened in flight, or the throttle opened.

Rate-of-climb indicators are provided with a vane at the back of the dial, which must be open to true static air pressure if the instrument is to function correctly. Many airplanes are subject to peculiar cable or cockpit pressure. In such cases, if the climb indicator vent is left open at the rear of the instrument board, the instrument may perform accurately as described above. The remedy is to provide a true static vent. If the winged indicator mechanism is properly made and free trap doors, as made here provides a connection.

Put a "T" in the static line and use a copper tube from the open arm of the "T" to the rear connection of the climb indicator. Use cane and cut strings and soldered connections. The vent in the instrument is usually designed so that this may be done conveniently. To prevent any possibility of cockpit pressure entering the winged indicator, the case of the climb indicator should be made airtight. This may be done by applying a little Plastiline around the edge of the glass under the front window, and around the joint where the base plate of the instrument fits into the cylindrical case.

Radiator accounting on Ford freighter

THE Ford single-engine freighter (page 88, AVIATION, July, 1931) is one of the few conventional airplanes on the country today powered with a liquid-cooled power plant. The radiator for the 600 hp. Hispano-Suiza engine is mounted on the underside of the baggage below the pilot's cockpit. As shown in the accompanying photograph, it is



Above: Vent at the Mercury Choke

Right: Between the top and 200 gph. cooling gear

Volapet, a rod provided with shutters to control the temperature. Note that the radiator is not placed symmetrically on the center line of the fuselage, but is shifted slightly to the right to account for the twist of the airflow in the vaporstream.

Quick detachable streamlining

ONE of the most common complaints from maintenance men concerns the time usually required to detach and reassemble landing gear fairings to permit servicing operations on fuselage fittings. One designer's answer to such criticism is to be found in the streamline housing surrounding the outboard fittings of the landing gear on the Douglas DC-3 Transport, said in

the American Airplane & Engine Company at Farmingdale, N. Y. (AVIATION, November, 1931, page 654). The exposed mechanism is completely enclosed in a streamline cap, the front portion of which is held in place by the tension of a spiral spring. To get at the fitting for grinding it is only necessary to grasp the front half of the cap, and to pull it away against the tension of the spring. By pulling forward several inches, and then raising the cap upward, the spring may be engaged over the edge of the rear section, and the cap dropped backward completely out of the way.

An unusual tail unit

THE Mercury Chu lightest is characterized by the absence of level horizontal tail sections. The fuselage tapers down to a wedge in the horizontal rather than to the vertical plane as is usual practice, and the elevators are hinged directly to the horizontal and post. Fin and rudder are of conventional design, carried on top of the fuselage, with the fin structure to the upper keelcase.

Center section gasoline tank

THE new fuel supply of the new Model 21 Pilot trainer, (AVIATION, August, 1931, page 458) is carried in the center section of the upper wing.



Fuel tank of the Ford Freighters

The fuel chamber tank is held in place between the front and rear spars by means of a pair of flat strips which permit its removal through the lower surface of the center section. The problem of carrying the show and structural stresses across the center section without interfering with the removable feature of the tank has been solved by the use of a double-cross bracing at streamline ribs. One pair of cross ribs lies in the plane of the upper edge of the wing spar, and the other



German aircraft wheel jack



Quick detachable in center section of Ford 21 trainer

THE BUYERS' LOG BOOK

Aluminum paint

Aluminum Industries, Inc. of Cincinnati, Ohio, has announced a new painting material known as *Aluminex* which may be used on metal, wood, fabric, or stone. The coating is said to be highly resistant to heat and corrosion and unaffected by weather. The present purchase of the material is "Aluminex," manufactured by the Aluminum Company of America.—*Aviation*, February, 1932.



Crank filing machine

Continuous filing machines

For tool and die makers' use, Cook Bros. of 50th and National Ave., West Allis, Wis., have put on the market two new types of continuous filing machines. The model B-1 is for bench mounting and the A-2 a floor mounted machine. Both are designed for external or internal filing of work requiring close fitting in turning. The Model B-1 will handle flat surfaces up to 4 in. in height and the A-2 up to 7½ in. Both are motor driven through pulleys and V belts.—*Aviation*, February, 1932.

Portable paint sprayer

A small and portable spray painting outfit easily carried and operated by one person has recently been announced by the DeVilbiss Company of Toledo, Ohio. This unit is known as the DeVilbiss M-3-4667 and may be used as supple-



The Caterpillar 15 tractor

mental equipment for larger paint spraying outfits for painting work on small painting or finishing operations. The machine is self-contained, both compressor and motor being completely mounted on a rubber-tired metal base. The motor can be operated from any convenient light socket.—*Aviation*, February, 1932.

Caterpillar tractor

A new model tractor, the Caterpillar 15, has been recently put on the market by the Caterpillar Tractor Company, of Peoria, Ill. Models of this type have been found useful for crawling and work

material on airports, and also for moving large planes in or out of hangars. This machine is equipped with a four-cylinder, four-cycle, water-cooled engine of 34 in. bore by 4½ in. stroke operating at 850 rpm. It will exert a maximum drop or pull of 90 hp. at speeds ranging up to 4.7 mph.—*Aviation*, February, 1932.

Automatic hose

An improved tool for grinding internal combustion engine cylinders has been announced by the Macromatic Hose Corporation of Detroit, Mich., in the model 1A-G P three-finger automatic hose. All working surfaces of the new tool are carburized, hardened and ground. The stones are mounted on self-holding holders, designed for easy replacement and to eliminate the possibility of the holder holding cylinder walls after stone has been partly worn away.—*Aviation*, February, 1932.

Electric tachometer

The Weston Electrical Instrument Corporation of Newark, N. J., has developed and put on the market an aircraft tachometer of this electrical type. The apparatus consists of a compact direct-current magnet generator to be mounted directly on the engine, and an indicator for instrument board mounting calibrated to read directly in revolutions per minute. The two units are electrically connected by flexible wiring. This type of apparatus is especially adapted to measuring the speed of various engines on multi-engine airplanes. The generator is equipped with a standard S.A.E. tachometer coupling and can be applied directly to the majority of aircraft engines by easily connecting and locking in place on the engine tachometer outlet.—*Aviation*, February, 1932.



DeVilbiss portable sprayer



Goodyear Sport Ship mounted on Goodyear Timken-equipped Airwheels.

GOODYEAR AIRWHEELS, manufactured by The

Goodyear Tire and Rubber Company, are standardized on Timken Bearings. The reasons are quick take-off, easy handling, prevention of wear on axles and hubs, simplified lubrication, avoidance of adjustment, smooth, even braking. Timkens carry the severest thrust and heaviest radial loads, prevent wheel wobble and check ground looping tendencies. See that your new planes are Timken-equipped.

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H. J. Gossens, T. van den Broek, H. A. M. Meijer

9. J. EVAN ELYING, SCHOOL

ADMINISTRATIVE OFFICES: 1500 AIRPORT
SUITE 2000 BAYVIEW AVENUE
SAN DIEGO, CALIFORNIA
92161-1500

derivative (1992)

Students: Peter and Shigeru
Company of California, Inc.
Los Angeles, California

gratifying. Dr. J. H. Seville, the

David Brown

Twelve years of flying experience have grown to us that the location and the time of a place are highly important factors in the world.

In the making of my government approved business strategy, I submit to members of the House-Senate Budget and Labor Committees, and also to the Joint Subcommittee on Labor Matters, that as a business owner the scheduled flight calls the steps to a last great analysis of the new country's major elements, the result of a short meeting, or the early stages of an ongoing contract flight. Therefore, government should not force labor and profit against the new nation.

It feels that the adoption of language literally as checked will give us at least, looks places up time as research, rather let principles of operating cases and the maintenance of relevant system, structure.

These data imply

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[Signature]

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TUNE IN: Gaylene Larson yet to hear John Philip Sousa call his band... Arthur Foye and his band... Nashville Quorum and Gaylene Concert Dance Orchestra... over Wednesday and Saturday nights, 7-9 P. M., R. G. Red Network, WJLB and Associated Stations.

[illegible]

EXERCISES AND ANSWERS

GOODBYE YEAR

EVERYTHING IN RUBBER FOR THE AIRPLANE



NOW...

a new teletypewriter service

TELETYPEWRITER exchanges, similar to telephone exchanges, now make it possible for any subscriber to this service to typewrite by wire instantly to any other subscriber, whether he be around the corner or across the continent. Subscribers can type back and forth by wire for short or long periods, just as they now talk by telephone.

Messages, inquiries, reports—typed in your office—are instantly and accurately reproduced on any other subscriber's teletypewriter. Identical typewritten copies, made by both sending and receiving machines, are available for permanent records.

This new service differs from existing private-

line teletypewriter service in that any subscriber may ask for any other subscriber and be connected immediately. The cost is low.

Teletypewriter Service provides two-way communication.

Speed of connection is as fast as telephone service.

A typewritten record, one or more copies, is produced simultaneously by both sending and receiving machines.

Material transmitted may be recorded on forms if desired.

Teletypewriters are like ordinary typewriters in appearance.

Teletypewriters can be operated by any one who can operate a typewriter.

You can use Teletypewriter Service any time you need it.

A most economical form of record communication.

FOR FURTHER INFORMATION JUST CALL



YOUR BELL TELEPHONE BUSINESS OFFICE

B G

96%
(108 out of 112)
of all engines participating
in the
MIAMI AIR RACES
were
B. G.
EQUIPPED

Of the 297 aircraft engines on the field during the period of the races, 249 (84 per cent) were B. G. equipped, proving the preference for B. G. Mica Aviation Spark Plugs.



THE B. G. CORPORATION

Contractors to the United States Army and Navy and Aircraft Engine Builders
136 West 52nd Street, New York Cable Address: Goltsvea, New York

3-PLACE 110 hp. WARNER-BIRD \$4395



PERFORMANCE

Top Speed	117 m.p.h.
Cruising Speed	80 m.p.h.
Landing Speed	34 m.p.h.
Rate of Climb	60 ft.
Climb Sea Level	650 ft. per min.
Service Ceiling	16,500 ft.

THE BIRD
CHALLENGE
FOR
1932

STANDARD EQUIPMENT

Hinged Air Sucker	Dual Ignition
Foot Aid Kit	Navigation Lights
Dual Controls	Air Wheel
Cockpit Cover	Air Wheel Swivel
Reserve Component	Wood Propeller

Like all planes in the Bird line many improvements have been incorporated in the new Warner-powered Bird.

All Bird Planes may now be purchased on liberal terms. As an example, the Time Purchase Plan on the three place 100 hp. Warner Bird is as follows:

100 hp. Warner Bird (3rd model)	\$2995.00
Down payment	\$1195.00
Balance due on contract	\$1800.00
divided into 12 equal monthly payments	\$150.00
plus monthly insurance, interest and finance charges	\$30.00
Making 12 equal monthly payments of	\$180.00

Payments as given above would apply in like proportion on all other Bird models, or, if the first Down Payment were larger, the monthly payments would be correspondingly smaller.

Bird planes merit competition in performance with any others in their power range—including planes equipped with rotor wings, slots, flaps or variable camber wings.

BIRD AIRCRAFT CORPORATION, Glendale, L. I., New York

See the complete Bird Line at the Detroit Show
April 2 to 10, 1932

*WRITE FOR FULL INFORMATION ON OUR INSURANCE, INTEREST AND FINANCE PLAN which also gives details of the Time Purchase Plan for each model.

CURTISS-WRIGHT FLYING SERVICE COOPERATES

In addition to our present authorized dealers and representatives, we wish to announce that CURTISS-WRIGHT FLYING SERVICE, Inc., has selected the Bird plane as being best in its

class and has been authorized to represent us on Sales and Service throughout the United States through their thirty branches and 323 dealers.

WHEN THE TEMPERATURE
VARIES WIDELY . . .What can the laboratory tell you
about the oil you ought to use?

With winter and summer conditions only a few hours' flight apart, you need the safety afforded by the best there is in oil. The practical ideal is the lubricant which satisfies all of the requirements of your engine at normal operating temperatures, has a low pour point, and changes from its viscosity over the range of temperatures encountered. While flight tests are the final proving ground, the laboratory can guide your choice. What are their tests?

VISCOSITY—as determined in the United States, is the time in seconds required for 60 cc. of oil to flow through an orifice under standardized conditions.

Your engine must have proper lubrication at operating temperatures. Protection of bearings, cylinders, and pistons is secured only by an oil of the correct viscosity.

VISCOSITY RATIO—indicates the rate at which oil "thickens" with a given drop in temperature on, conversely, the rate at which it "thins out" with a temperature rise. To determine this, the laboratory measures

the viscosity at more than one temperature and compares the results.

Since aviation engines require efficient lubrication over a wide range of operating temperatures, it is most desirable to have the characteristics of the oil change as little as possible under different conditions.

POUR POINT—is the lowest temperature at which oil will flow when chilled under standardized conditions. Some oils congeal at a temperature as high as 40° F.; others may remain fluid at temperatures of zero or below.

Unless your oil has proper viscosity and pour point characteristics you will experience difficulty in starting, improper lubrication, and excessive engine wear for the period immediately after starting.

Stanavo engineers have developed a lubricant which will safeguard your engine under the most severe conditions. It is the best combination of these qualities based on the extensive experience of the companies affiliated with Stanavo. It is uniform the world over.

STANAVO
AVIATION GASOLINE
AND ENGINE OIL

STANAVO SPECIFICATION BOARD, Inc.
Organized and Wholesaled by

Standard Oil Company of California
845 Bank St., San Francisco

Standard Oil Company (Indiana)
181 St. Nicholas Ave., Chicago

Standard Oil Company of New Jersey
30 Broadway, New York City

Boys Flying
Spanish America



WIND 'ER UP!

WIND 'ER UP... Connect... Fuelled with Socony Aviation Gasoline and lubricated with Socony De-Waxed Motor Oil, each engine leaps into action. Keeps running smoothly.

In coldest weather, Socony De-waxed Motor Oil warms quickly to running temperature and spreads its protective lubrication film on cylinder walls.

Use these Socony products next time and enjoy perfect engine performance.

SOCONY

AVIATION GASOLINE DE-WAXED MOTOR OIL

STANDARD OIL COMPANY OF NEW YORK INC.

A SMALLER WORLD IN 1932

The world is smaller this year — it will be even smaller, quicker, richer, as commerce and its servants increasingly travel the swift, shortened highways of the air.

Entering the greatest decade of the air, the General Aviation Manufacturing Corporation has concentrated all its administrative and manufacturing activities in the great Curtiss-Caproni plant at Baltimore, in order to unify the industry's highest resources in developing new and advanced types of aircraft.

Here are joined the skill and enterprise of world-famous designers and engineers — the experience of more than ten years of fine aircraft production — the vast modern manufacturing facilities of the Curtiss-Caproni plant — to combine new economies and advantages for plane operators and users.

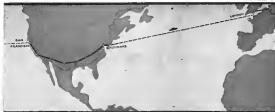
Add these things to the outstanding performance and dependability records of G. A. M. C. ships, and you will know why the entire industry looks to Baltimore for vital new developments in air transportation.

GENERAL AVIATION MANUFACTURING CORPORATION

Division of General Aviation Corporation

Mailing Address: Dundalk, Baltimore, Maryland

New York Sales Office: 1775 Broadway



Around the World...



Baltimore, Maryland

Mr. Glenn L. Martin
welcomes
Mr. and Mrs. C. H. Day
upon their return from
their World Tour.

THE GLENN L. MARTIN

A Subsidiary of the Glenn L. Martin Co.



with a MARTIN MOTOR

"Motor functioned perfectly at all times," says Mr. Charles Healy Day, Flier and Designer of the Light Plane, "Ernaut," in which Mr. and Mrs. Day made 15,000 mile World Tour.



Martin superiority is again proved by actual achievement.

Fuel consumption under six gallons per hour.

Maximum power output sustained under the most severe temperature conditions.

Repair simplified by Martin design. Maintenance simplified by elimination of rocker arms and push rods—a special Martin feature.



MOTORS COMPANY

Baltimore, Maryland, U. S. A.

FAMOUS FLIGHTS WITH THOMPSON VALVES

This advertisement is one of a series illustrating famous airplane flights in which Thompson Valves were used.



CONQUERING THE PACIFIC

with Pangborn and Herndon

WITH their sturdy Bellanca reared away from Floyd Bennett Field on July 28th, Clyde Pangborn and Hugh Herndon little expected what awaited them in the Far East—their arrest in Japan . . . interminable lawsuits . . . bad weather . . . endless delays. Yet three months later found them back on native shores—popular heroes! Heroes of the Trans-Pacific flight record—a spectacular non-stop crossing of 4,388 miles!

After their take-off at Suburba Beach, Japan, these courageous pilots dropped all of their ship's landing gear into the ocean to reduce air resistance. They relied implicitly on the Bellanca's 425 hp "Wasp" motor to carry them through. It responded with perfect performance for thirty-one hours—when Pangborn successfully landed the wireless plane at Wenatchee, Washington. Throughout the moon-making flight, at the heart of their "Wasp" motor's remarkable performance, a set of Thompson Valves again helped in the making of aviation history!



THOMPSON PRODUCTS
INCORPORATED

General Office, Cleveland, Ohio T. & A.
Patterson CLEVELAND and DETROIT

Thompson Valves

Announcing THE WACO "MODEL A"

... AN IDEAL AIRPLANE FOR THE PRIVATE FLYER
WHO WANTS TO "DO PLACES AND DO THINGS"



● WACO is making its first 1932 two-place, side-by-side airplane designed exclusively for private flying. Testing the price of the market, some months ago we determined that this was the sort of airplane generally wanted. And advance orders have confirmed our diagnosis.

This is one airplane thoroughly adequate, in performance and in baggage provision, for sustained type. It is built for comfort, not for racing. It emphasizes the quick release facilities landing system of previous WACOs, which make landing conditions lessened. Its wide wing gives ample lift even for two people, but with the intricate counter-rotary that streamlines the air it has

two baggage compartments—180 lbs. of passenger baggage can be stowed in the front, with room for the two passengers and two brief boxes; 20 lbs. can be stowed in the rear, which provides for 100 lbs. of gear, or more, at flying tackle, or your choice and your destination may dictate.

The "winter leg," which gives closed-circuit control, is discoverable in thirty minutes, if not when you push the fuel and the location of the side access points.

Power range, offered for variety of use, is from 100 h.p. to 160 h.p. with price range from \$2595 to \$4960, completely equipped, flying.

Only the best materials and workmanship go into the Waco. If you don't see this in the further details?

There are not more than 100 WACOs of this type in the world. The Waco is a limited production airplane. The Waco is a limited production airplane.

THE WACO AIRCRAFT COMPANY, TROY, OHIO



WACO LEADS IN AIRCRAFT REGISTRATIONS



"A key to better planning"

To Advertisers

Advertising space for the March Statistical issue close February 11. Attention: advertising copy and space, and no more color, will give exceptional advertising value in the statistical number. Red or blue is available at \$50 a page; other commercial colors at \$60.

is the way one executive described AVIATION's annual March statistical number. The industry's standard reference book, it will give all the facts about aviation during 1931. A complete, authoritative picture of the year's progress—statistics, charts, informative data, illustrations, trends and their interpretation. Growth of transport operation, activities of manufacturers, operators and airports. Advertisements of products, prices and sources of supply.

AVIATION's annual statistical number is the recognized basis for future planning. Owners of letters from industry leaders have ex-

pressed their appreciation of its completeness, reliability and reference value. Thus manufacturers, operators and airport officials look forward each year to receiving AVIATION's statistical number, and make many requests for extra copies.

Advertisements in the statistical number will be closely read by those who plan, buy or influence the purchase of manufacturing and operating supplies and equipment. Its reference value will give greater life to your advertising.

Advise us of your space requirements for the coming issue!

AVIATION

Member A.S.C.

McGraw-Hill Publishing Co., Inc., 330 West 42d Street, New York, N. Y.



ADDED safety, simplified ground maneuvering are characteristic of planes equipped with Bendix wheels and brakes.

The wheel and brake for aircraft was original with Bendix. Most improvements since have been theirs; example—the new Bendix roller bearing wheels.

A natural result then—those particular maneuvers of aircraft that bring wheel and brake into play are performed more surely, more satisfactorily by Bendix-equipped planes.

BENDIX BRAKE COMPANY
SOUTH BEND, INDIANA
(Subsidiary of Bendix Aviation Corporation)

BENDIX FOR AIRPLANE WHEELS and SAFETY **BRAKES**

FULLY PROTECTED BY PATENTS AND APPLICATIONS IN U. S. AND ABROAD

At All Sales Yards

Do you know that . . .

each month our subscription department receives more than 150 requests for "Back" issues of AVIATION?

♦ ♦ ♦

If we printed extra copies of our monthly issues, we would be glad to comply with these requests, but unfortunately we have no way of knowing in advance just how many of our newsstand readers will "miss" an issue.

♦ ♦ ♦

But We Do Know—that each of these requests indicates a reader has "missed" just the issue he could make valued use of.

Insure your receiving
AVIATION regularly by filling in the
coupon below, today . . .

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330 W. 42d St.
New York City

Subscription Rates:
United States and Mexico, \$3 a year;
Canada (including Quebec, \$3.75);
Europe and South America, \$5 a year;
All other countries, \$6 a year.

Here is my check for \$3.00. Send me AVIATION for one full year.

Name

Address

City and State

Nature of Activity

Look to electric instruments for performance at low cost



This plane is completely equipped with General Electric instruments, fuel gauges, wing-edge landing lights, and a G-E speedometer.



CONSIDER, for example, General Electric instruments for indicating oil pressure and temperature. They are connected to the engine fittings by electric wires, and they require no tubing or other mechanical connections. This advantage is also characteristic of the G-E engine-temperature indicator and the G-E tachometer. In fact, it is one important reason why electric instruments cost less to maintain.

The panel illustrated is the most completely electric aircraft instrument panel ever assembled by any manufacturer. All of the engine instruments, the magnet compass, the turn indicator, and even the altimeter are electrically operated. We invite your interest in this thoroughly modern equipment. Address General Electric Company, Aeronautics Section, Schenectady, N. Y.

Key to numbered General Electric instruments shown above

1. Oil-pressure indicator
2. Oil-temperature indicator
3. Engine-temperature indicator (thermo-couple type) and exhaust-temperature indicator
4. Electric tachometer
5. Electric control switches and fuses
6. Voltmeter
7. Magnet-compass indicator
8. Electric turn indicator
9. Sensitive turn indicator
10. Magnet and compass
11. Compass-contrast controller
12. Turn-contrast controller
13. Magnet-compass controller



KEEP OUT
of the "CATERPILLAR CLUB"

Oil-caused grief often shows up AFTER it's too late to do anything but bail out and trust to your 'chute.

Guttridge Oils are good insurance against forced membership in the Cartegallians.

Look into the faces. You'll find Gulf-pork Oils show remarkably flat viscosity-temperature curves. That's proof of the way they hold their body under high-temperature operating conditions. Yet they never become objectionably stiff and tacky at low starting temperatures.

Your tachometer will show you a smoother, faster running motor with Gulfgrade, assurance of greater power and life when you "give her the gun" in a sudden emergency.

Compare Gullipeds Oils to the next best. Ferrelle there ed you can obtain. The Com-
and 1212 will show you that Gullipeds of
comparable viscosity seems to have a $\frac{1}{2}$ in
as much better!

If you've been beating the heat lubricant... the ad that makes most car hours... power... find it in Gulfstate

GULF REFINING COMPANY
General Sales Offices, Pittsburgh, Pa., U.S.A.



Gullpride
Oil



**MORE
AIR HOURS**

Gulfports Oil is 100% paraffin base mineral oil refined by the newly Advanced Ultra-deepmethod Technology in Gulfports. Gulfports Oil exhibits a virtually flat viscosity-temperature curve, high flash and fire values, and low pour point.

Quilgoate Oil is made in three var-
ieties: 75-100-120-150 and 200-250
APIV, providing a superior lubri-
cating for all types of diesel engines,
under all operating conditions.

Ask for Quilgoate Oil and you'll
never be bothered by engine oil
again.



BY *AIR* TO ...
HAMILTON STANDARD

By virtue of its new location adjacent to Rensselaer Field, Hamilton Standard is now in position to render practical assistance to airplane manufacturers and operators in connection with propeller problems.

You are invited to take advantage of its facilities for propeller flight testing. Visiting planes landing on the most modern airport in Connecticut find ample hangar and service facilities.

Division of United
Aircraft and Transport
Corporation

REPORT
REPRESENTATIVE
UNITED AIRLIFT
EXPORTS INC
ONE PARK AVENUE
NEW YORK, N.Y.

HAMILTON STANDARD PROPELLER COMPANY
EAST HARTFORD, CONNECTICUT



PLANE TRAVELERS

KEEP IN TOUCH WITH THE WORLD



MAKE EVERY PLANE
A POSTAL
TELEGRAPH OFFICE

...WITH POSTAL TELEGRAMS SENT EN ROUTE

It's just human nature for passengers to leave things entrusted to send a journey has started. Reservations...appointments...confirmations. Things the train or ship messenger can settle en route with a message in hand or office on board. Things the air traveler can get off his mind easily... cheaply... conveniently... when the plane is a Postal Telegraph office.

And to make the plane a Postal Telegraph office? That's merely a matter of providing Postal Telegraph blocks where passengers can reach their friends

and, and ensuring immediate to the passengers' messages or scheduled messages.

That Postal Telegraph enables air transport companies to offer their passengers speedy, accurate, dependable contact with the entire world, through the great International System of which Postal Telegraph is a part. Then it gives them at no extra cost to add convenience that every passenger will appreciate... a service that links modern travel with modern communication in a new way.



Postal Telegraph is the only American telegraph company that is first a world subsidiary of an independent international system under a single management. Through the great International System of which Postal Telegraph is a part, it reaches America, Asia, The Pacific, Europe, Commercial Cable, Cable, America, South America and the West Indies near all American Carriers, and ships at sea via Marine Radio.

THE INTERNATIONAL SYSTEM

Postal Telegraph

Commercial
Cables



AM America
Cables

Wireless Radio

Stinson Scores Again—



Announcing the Stinson Model R

Greatly increased speed... high powered performance, without high cost... brilliant new beauty... completely streamlined... greater safety... more inherently stable than any previous Stinson... unobstructed seating cockpit... larger, roomier insulated cabin... wider, adjustable large back seats... new upholstery, colors and refinements... under doors... plane exterior finish... new type windshield... shock-proof glass... new indirectly lighted instrument panel... Pioneer instruments...

electric starter... quiet, reliable 215 horsepower Lycoming motor mounted on rubber... adjustable metal propeller... steel air wheels... roller bearings... self-energizing brakes... hydraulic shock absorbers... wheel levers... parking brakes... adjustable stabilizers... Only Stinson's success as world's largest cabin-carrying builder is the ability and sixty-five million-dollar resources of The Cessna Corporation, makes the Model R possible at its price of \$3595 (c.a.) Wayne, Mich. Equipment other than standard extra.



Interior cockpit, rubber seats, steel fuselage and wheels, major parts of new turbine structure



New windshield, improved cabin, new indirectly lighted instrument panel... shows interior easily reached



Under doors, extra storage space, streamlined landing gear... wheel lock-off from motor seat



Great, rapid, streamlined fuselage construction and complete ground... motor... Stinson speciality airplane



THE POPULAR STINSON MODEL "R"

201 H. P. Lycoming powered four-passenger cabin atmosphere has broken all records for cabin plane sales during the past two years. Public acceptance makes it possible to build this plane, improved in quality for 1932, at the exceptional low price of

\$4595
c.a. WAYNE, MICH.

Equipment other than standard extra. Prices subject to change without notice.

STINSON AIRCRAFT CORPORATION, WAYNE, MICHIGAN
Divisions Cessna Corporation



More Than Ever "The Aircraft Standard of the World"

THEIR Confidence was Justified



WHEN THE SHIPWRECK DRAILED IN 1903,
JOHN R. PATTERSON SAID:

"The year has been unparalleled in the history of the United States. Great questions were to be solved, every industry was reorganized. Issues about drama, war, but courage, while a few pointed ahead and worked hard to get out with confidence in the future. We did not in the hard times, without work and work. When times get better, we advanced the more and worked the harder."



WHEN THE IRON SHIPWRECK DRAILED IN 1903,
ANDREW CARNEGIE SAID:

"This point will soon get its course and pass away leaving us unshaken to the future, in the future, at similar point of industry, business needs, expansion of our business."

We have had the greatest expansion of industry since. Industry had to come out from hardship. Nothing can stop the rapid progress of the Republic. We are all men."



WHEN JOHN MARK CLARK SAID IN 1903,
MARK CLARK SAID:

"Our members have been buying only what they can sell quickly for cash. The economy has led to such a point that the only way to get out is absolutely necessary. People everywhere have been saved. They are going over that."

"Our people are the greatest consumers of food and manufactured goods in the world in normal times—and normal times are coming back."

AMERICA CAME THROUGH!

In 1893 panic rule walked through the land. 467 banks failed in a few months. Millions of farmers and business that down everywhere. Bankruptcy was on every hand. America had twice as many unemployed per thousand population as she has today. But she put them all back to work.

In 1907 panic broke loose. The production of pig iron dropped 50% in less than a year. All but the strongest men lost heart—"We are ruined," they declared, "recovery cannot come in our time." Yet in two years prosperity had returned.

In 1921, when many honest and thoughtful people were predicting worse conditions, the country was already beginning to climb to the greatest era of prosperity it had ever experienced.

History tells how America has fought and won 19 major depressions. Good times always follow hard times, as early as day follows night. Prosperity always comes back. It is coming back this time, too.

Above all things, let us have faith.

America Has Beaten 19 Major Depressions
She will Beat this one

THE NATIONAL PUBLISHERS ASSOCIATION

"As the most nearly self-contained nation, we have within our own borders the elemental factors for recovery."

Given the International of the Committee on Unemployment Plans and Statistics of the President's Department on Unemployment Relief

SAFE . . . FAST . . . ECONOMICAL "FLEETSTERS"

Will Fly This Route



As Usual

Wright Cyclone Engines

Will Contain

SRB BALL BEARINGS

Ludogone Airlines, Inc. has selected 1932 model "Fleetsters" for high speed passenger service on their New York to Washington run. Into each "Fleetster" will go a 600 h.p. Wright Cyclone Engine containing rugged, improved SRB Ball Bearings.

"Dependability in every part"—a stringent Wright standard—explains the extensive use of SRB's at important bearing locations. Every year Wright Engines power millions of miles of transport travel. . . . engines in which SRB Ball Bearings provide reliable, enduring support for crankshaft—propeller thrust and other bearing positions. The diamond tread mark of SRB has long been a symbol of confidence in the aviation industry. Today—SRB Ball Bearings are used by practically all important aircraft engine manufacturers.



STANDARD STEEL AND BEARING INCORPORATED
Division of Martin Engineering Corporation
PLAINVILLE CONNECTICUT

Ball SRB Bearings



HEATH STILL LEADS

Again Heath demonstrates why it is America's most popular Sport Plane. Performance—Safety— Economy—these are the ways Heath qualities and now is added the quality of

EASY OWNERSHIP

FLYING in the greatest sport known—why not enjoy it? You can buy your Heath, less motor, for only \$499.00, ready to assemble and cover. Finished parts supplied include welded brackets, welded tail group, welded ailerons, controls, landing gear, etc. Can be completely assembled at home in a few weeks time.

Or start from progressive stages of parts. First group, \$15.00, including set of 20 legacy scale ribs. You don't have to be a mechanic to build your Heath under this system.

Heath Model LN is approved by the United States Department of Commerce, and home assembled Heath LN models are eligible for Federal License, A T C No. 450.

You can fly your Heath anywhere, safely and economically, and you can pay for it as you fly.

Fill out the attached coupon and send it with 15c. for descriptive matter and information about our partial payment plan. Special club offers.

HEATH AIRCRAFT CORPORATION

Dept. A S, NILES, MICH.

Heath Model LN E-4 engine	\$1074
E-4 engine	\$499
Heath E-4 engine	\$300

HEATH AIRCRAFT CORPORATION,
Dept. A S, NILES, MICH.
Send no money to begin with the new Heath.
I am interested in: ☐ complete program plus
☐ 1st group ☐ 2nd group ☐ 3rd group
Name _____
Address _____ City _____



A History of Aircraft

by P. ALEXANDER MUNROE
and ERIC MUNROE

A NEW BOOK FROM PUBLISHER
McGraw-Hill, 330 West 42d Street,
New York

THE science of flying is not new. From the earliest times man has dreamed of escape from the earth and sought the air and earth. The story of man's quest for flight is chronicled in the pages of this book. From the first crude attempts to make artificial wings to the latest designs and theories of the present day, the story of aircraft is told in a clear, concise, and interesting manner. The book is divided into three parts: the first part deals with the history of flight, the second part with the principles of flight, and the third part with the construction of aircraft. The book is written in a clear, concise, and interesting manner, and is suitable for both the amateur and the professional. It is a valuable addition to any library or collection of books on aviation.

WHITTLESEY HOUSE

A Division of the McGraw-Hill Book Co., Inc.
330 West 42d Street New York

A Simple Navigation Method AERIAL and MARINE NAVIGATION TABLES

By JOHN E. GIBSON

Published by W. B. Eerdmans in 1928. Revised in 1931. This book is a simple, practical, and reliable method of navigation for both aerial and marine travel. It is written in a clear, concise, and interesting manner, and is suitable for both the amateur and the professional. It is a valuable addition to any library or collection of books on navigation.

THIS book presents tables for the use of the aviator, practical navigator and yachtsman in solving the line of position problem with accuracy, ease and rapidity. When used with the Nautical Almanac no other books are necessary for navigation purposes.

McGraw-Hill Book Co., Inc.
330 West 42d Street, New York

**MACWHYTE
TIE RODS**

—STREAMLINE
—SQUARE
—ROUND

MACWHYTE COMPANY
KENOSHA, WISCONSIN

Safe!

**Where there is no landing
there must be no failure**

For SPRINGS of any kind, of any material, for any purpose in motor, controls or landing gear, use

GIBSON SPRINGS

WM. D. GIBSON CO.
1800 Clybourn Avenue ••• CHICAGO, ILL.
Send for our Catalogue



CRANKCASE FOR RADIAL ENGINE MACHINED COMPLETE

BY
Gouvo-Nelson



THE machining of the crankcase and other vital parts of an aircraft engine should not be entrusted to inexperienced hands.

The crankcase built for a 200 hp. Diesel Radial engine shown above as a sample of Gouvo-Nelson work, was expertly machined by skilled, experienced workmen—keyed to the demands of the aviation industry, working with the aid of modern measuring machines and accurate testing equipment.

THE
GOVRO-NELSON
COMPANY
1931 ANTOINETTE DETROIT
CRAFTSMEN TO THE
AVIATION INDUSTRY

More than
100,000 people will visit
your exhibit
at the
**1932
NATIONAL
AIRCRAFT
SHOW**
DETROIT
APRIL 2nd to 10th INCLUSIVE



AIRCRAFT development and air travel port here will enjoy greater public interest and patronage during 1932 than at any time in the history of aviation.

Private plane ownership and commercial aircraft operations in the United States during the past year broke all previous records and now surpass every other country in the world.

The American public is eager to see and accept the latest developments in design and engineering. Your exhibit in the 1932 National Aircraft Show is your guarantee of participation in the world's greatest aircraft market.

**AERONAUTICAL CHAMBER OF COMMERCE
OF AMERICA, INC.**

39 East 46th Street, New York City

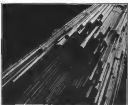
For space application and information address

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